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## ACUTE MALIGNANT OBSTRUCTION OF THE LARGE BOWEL

### An Analysis of 55 Cases

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THE pronounced decrease in the case fatality rate of large bowel surgery in recent years is due, as Wangenstein<sup>1</sup> has well put it, to "increments of gain" in "one item after another," which, though they be small as individual considerations, eventually "are reflected directly in an improved surgical mortality." Among these gains are improvements in anesthesia, a better comprehension of the importance of preoperative and postoperative care, the introduction of modern chemotherapeutic and antibiotic agents and their rational use, the control of intestinal distention by the Wangenstein apparatus and the Miller-Abbott tube; the prevention, and the control, if they develop, of postoperative complications; the more skillful management of poor risk patients suffering from constitutional diseases such as cardiovascular disease, renal disease and diabetes, which are most frequent in the age period in which carcinoma is most frequent; and advances in surgical technic, especially the perfection of aseptic intestinal anastomoses. It has the sound of a paradox, but it is demonstrably true, that as the surgeon has become bolder in his resection of carcinoma of the large bowel, a lesion which can be cured only by radical surgery, so have the results of his surgery become better and better.

Most of the recent studies on carcinoma of the large bowel re-

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port brilliantly successful results in elective resection but, for some curious reason, with very few exceptions these studies pass lightly over a phase of the disease which is a most fruitful source of disaster. I refer to acute intestinal obstruction from the malignant process, which is only infrequently discussed in its own right and which is glossed over in most articles on carcinoma of the large bowel with statements to the effect that patients with acute obstruction obviously must be decompressed by surgical means before resection is undertaken.

For these reasons, that is, the rather cavalier treatment which malignant obstruction of the large bowel has received in the recent literature and its extreme importance as a factor of mortality in large bowel surgery, I am reporting the 55 cases upon which this communication is based. So far as acute obstruction of malignant etiology is concerned, 55 cases is a relatively large series. Only 35 such cases, according to Dennis,<sup>2</sup> were observed over a 6 year period at the University of Minnesota Hospitals, and reports from other clinics concern series of about the same number. Fifty-five cases, on the surface, seems a small series from which to draw conclusions, but as a group, and also as individual cases, they clearly illustrate the causes for many of the fatalities in malignant obstruction of the large bowel, and they also illustrate, with equal clarity, the methods by which patients with this complication can be saved from death. I might add that the lessons to be derived from these cases are in no respect new. Rankin<sup>3</sup> has been emphasizing them for almost a quarter of a century, and so have many other authorities in the field of large bowel surgery.

The 55 cases which make up this series were collected from Charity Hospital of Louisiana at New Orleans and from Touro Infirmary in the same city. During the 3 year period ending Dec. 31, 1945, 135 patients with carcinoma of the large bowel, exclusive of the rectum, were treated at Charity Hospital, 35 of whom (25.9 per cent) were completely obstructed. During the 6 year period ending Dec. 31, 1946, 68 patients with carcinoma of the large bowel, exclusive of the rectum, were treated at Touro Infirmary, 20 of whom (29.4 per cent) were completely obstructed. In other words, more than a quarter of the patients in a series of 203 cases of malignancy of the large bowel reached the surgeon with a complication of the gravest import superimposed upon a primary lesion that is in itself potentially lethal.

It might be well to emphasize at this point that the 55 cases in this series were managed by 25 different surgeons, one of whom

was responsible for 8 cases but 10 of whom were responsible for only 1 case each. All but 1 of the 35 cases at Charity Hospital were handled by residents, 13 of whom were concerned. As a result of the distribution of material among so many surgeons, whose skill and experience varied widely and whose points of view varied equally widely, there was no such uniformity of surgical practice in the management of these cases as there would be, for instance, in a series of cases reported from such a clinic as Wangenstein's. On the other hand, the high case fatality rate, almost 33 per cent, is probably more representative of the general mortality of acute malignant obstruction of the large bowel than is the far more favorable rate reported from clinics in which all cases are managed by the same general routine. These remarks, however, do not apply to the postoperative treatment employed in these cases, which with few exceptions followed established methods and was vigorously and correctly applied.

#### THE BACKGROUND OF MALIGNANT OBSTRUCTION OF THE LARGE BOWEL

Carcinoma is by far the most common cause of acute obstruction of the large bowel. There is general agreement that perhaps 90 per cent of all obstructions of the large bowel are of malignant origin and that about a third of all patients with carcinoma in this area eventually develop complete obstruction or the chronic variety. This series, as already intimated, includes only complete obstructions. Cases of intermittent or partial obstruction, even those which were submitted to surgical decompression or defunctionalization prior to radical surgery, have not been included. The incidence of acute obstruction in various series recorded in the literature ranges from as much as 35 per cent to as little as 5 or 6 per cent. Some series in which the incidence is high include cases of chronic as well as acute obstruction, though the consideration of the two types, which differ fundamentally in pathologic changes and in case fatality rates, as if they were one, seems quite without logic. Series in which the incidence is unusually low are usually from clinics in which little emergency surgery is done.

The fact that malignancy is the cause of the obstruction immediately introduces a number of considerations which set occlusion of the large bowel apart from occlusion of other origins. The first and most important is that the patient is at once in double jeopardy, from the malignant disease and from a complication that is exceedingly serious in its own right. In obstruction due to almost all other causes the correction of the obstruction also corrects the cause of

the obstruction. In primary carcinoma of the intestine the malignant growth must be removed also—though not, as will be pointed out later, at the same time—if the patient is to have any chance at all of ultimate survival.

A second consideration is that the patient is likely to be middle-aged or older. The fact that most patients with carcinoma of the large bowel are relatively or absolutely advanced in years introduces complications not met with in younger persons, including degenerative diseases, particularly cardiovascular disease, though age in itself is no longer regarded as a contraindication to surgery. That it does play some part, however, is clear from the fact that in this series the average age of the group which survived was 53.4 years, against an average age of 55.8 years for the whole series and of 60.7 years for the group which did not survive. In this series, unlike many reported series, organic disease was present in only a few patients and on the whole played no important part in the deaths which occurred.

The age range in this series was from 13 to 86 years; both patients at the extremes of life, incidentally, were numbered among the survivors. That 11 of the 55 patients were under 50 years of age and that 2 were under 30 years of age is an interesting commentary on the all too general belief that carcinoma is a disease of middle and late life. The sex incidence is not significant in so small a series, but to those accustomed to treating negro patients, it is important that 24 of the 35 cases at Charity Hospital occurred in this race, and it is also not surprising that 10 of the 12 deaths at that institution occurred in the same race.

A third important consideration is that the patient with obstruction due to malignant disease has been ill for a considerable period of time even if, as happens in a small proportion of cases, there has been no previous evidence of it. During this time, although he may have gone about his usual activities, the malignant growth has been slowly reducing the hemoglobin and red blood cells, reducing the plasma protein, and otherwise sapping his strength and vitality. Patients who have been losing weight, as most of them have, are actually, to use Wangenstein's<sup>1</sup> term, "autocannibalistic." They have survived by living on their own fat stores. They are likely to have fatty livers, and as a result are not likely to tolerate extensive surgery well. In all respects they are in contrast to patients with small bowel obstruction, or with large bowel obstruction of nonmalignant origin, who, as a general rule, are precipitated into illness from a state of previous good health. When intestinal ob-



struction is not complete, patients with malignant disease can be carefully prepared for surgery by replacement of the carbohydrate, protein, vitamin and hemic deficiencies, as well as by chemotherapy and by bowel irrigations, but preparation is a time-consuming process, and the patient with acute obstruction literally has no time for it. In many such cases, therefore, the debility caused by the primary disease is added to the infirmities of age and compounds the surgical risk.

Exploration was omitted in so many cases that statements as to metastases are not worth very much. They were found in 4 of the 8 necropsies performed; and were found at operation in 2 other fatal cases. They were also found at operation in 2 of the surviving patients and were identified in the lungs by roentgenologic examination in still another patient with carcinoma of the sigmoid colon, in whom a paracecal abscess had been drained after perforation of the cecum. Patients who present metastases are less likely to survive the hazards of obstruction than are those without them, because carcinomatosis is always associated with low resistance and with disability.

Acute obstruction of the large bowel differs from acute obstruction of the small bowel in that it is most often of the closed loop type, the growth forming the distal occlusion and the ileocecal valve the proximal occlusion. When once the loop has closed, distention is rapid because each peristaltic wave forces the contents of the ileum into the cecum, while the competency of the ileocecal valve prevents regurgitation from the cecum into the ileum. As distention increases, edema, thrombosis, ulceration and infection occur in the bowel wall until eventually, if surgical relief is not achieved, perforation will occur. This series suggests, however, that the statement usually made that perforation almost always occurs in the cecum, because of its relatively thin wall and its distensibility, is not necessarily true. Perforation can occur at any point above the lesion. Of the 8 proved perforations in these 55 cases, only 2 developed in the cecum, 1 in a case of carcinoma of the cecum, and 1 in a case of carcinoma of the sigmoid; the latter patient developed a paracecal abscess, which was later drained. Four of the remaining perforations developed in the sigmoid, in 2 instances as the result of traumatic manipulations at operation; 1 occurred in the descending colon, after Devine colostomy; and 1 occurred at the hepatic flexure.

Wangensteen<sup>4</sup> and his associates have made important contributions, as the result of both experimental and clinical studies, to the knowledge of the role of the ileocecal valve in obstruction of the

large intestine. Its competency is variable—by correlation of roentgenologic observations and findings at operation Dennis<sup>2</sup> determined that it was competent in 61 per cent of his series of 53 cases of acute colic obstruction—but whether it is important to know its status before operation is decidedly open to question. Attempts to differentiate between a competent and an incompetent valve are likely to delay surgical relief of the obstruction and may greatly jeopardize the patient's chances of recovery.

In 41 of the 55 cases, approximately three quarters, the obstruction occurred on the left side (Tables 1, 2). The same predominance of left-sided obstruction is noted in all other reported series and can readily be explained: The lumen of the left colon is generally smaller than the lumen of the right colon. Its walls are thicker and less distensible than the walls of the right colon. The fecal contents, which are more solid on the left than on the right, easily traumatize the malignant growth, causing secondary infection with ulceration, edema and swelling. Finally, the annular type of adenocarcinoma, which by its very nature readily gives rise to obstruction, is somewhat more frequent on the left than on the right.

In every case in this series the malignant growth was an adenocarcinoma, and in the great majority of cases it was of the annular type. In the few cases in which the growths showed gross fungating or polypoid characteristics, they also showed a marked tendency to infiltrate the wall of the colon and encircle the lumen, thus giving rise to obstruction.

#### CLINICAL PICTURE

In the great majority of cases in this series the history could be separated, usually sharply separated, into two periods, one of indefinite and the other of acute symptoms. The period of indefinite symptoms was usually characterized by an insidious onset and frequently by a lack of good health rather than a story of acute illness. On the other hand, when the histories were carefully checked, as a general rule it was possible to elicit a triad of symptoms including (1) altered bowel function, (2) melena, and (3) abdominal pain, which, until the onset of acute symptoms, was mild and transient. Some patients had had previous acute attacks suggestive of incomplete obstruction. In a small number of cases, as in most other series, the development of acute obstruction really seemed to be the first manifestation of the disease.

Symptoms and signs of acute obstruction of the large bowel in this series included:

1. Inability to defecate. Without exception every patient complained of this symptom and most of them complained, in addition, of inability to expel flatus. In many instances there was great desire and urgency, which probably explains why some patients had resorted to castor oil and other purgatives at home and in some instances repeated them.

2. Pain, which was present in practically every case and which was usually cramping and spasmodic.

3. Nausea and vomiting. Thirty-nine of the 55 patients vomited during the acute attack and 4 others complained of nausea but did not vomit. The remaining 12 patients did not complain of either nausea or vomiting. Wangenstein<sup>4</sup> has commented repeatedly on the possibility that acute obstruction of the large bowel can occur without vomiting, which is due, in his opinion, to the closed loop character of the obstruction and the absence of distention or the minimal distention of the small bowel.

4. Abdominal distention, which was present in every case and was usually pronounced.

5. Abdominal tenderness, which was present in almost every case and which was frequently localized or most pronounced in the lower right quadrant. The apparent localization of symptoms and signs is explained by the presence in that area of the distended cecum, which sometimes could be palpated as a tender mass, even when the malignancy was located in the left colon. Wangenstein,<sup>4</sup> who has studied this phenomenon, has pointed out that it is the result of the thinness of the wall of the cecum, and its greater distensibility, as compared to the rest of the colon.

6. The presence of an intra-abdominal mass, which is the malignant tumor itself. This was possible in only a few cases, the marked degree of meteorism present in most cases usually preventing its identification. Palpable growths were usually located in the cecum and lower ascending colon.

7. Low-grade fever, which was present in a number of cases, probably as the result of ulceration and infection of the intestinal wall proximal to the growth.

As in other series, the pronounced chemical changes which ensue so promptly in obstruction of the small bowel were not present in these cases. The only abnormal laboratory findings were a more or less pronounced leukocytosis, an increased proportion of polymorphonuclear leukocytes, a more or less marked anemia, most

pronounced in carcinoma of the right colon, and a marked reduction in the serum protein level.

Most of the patients in this series had been ill at home for 48 hours or longer before they entered the hospital. Acute symptoms, or, more correctly, symptoms which were more acute than the previous symptoms, had lasted longer than 7 days in 3 of the fatal cases and in 5 of the nonfatal cases. In several of these long-lasting cases the impression was received that an almost complete obstruction had become complete during this period. In this type of case the difference between the insidious onset of large bowel obstruction due to malignant disease and the abrupt onset of obstruction due to nonmalignant causes, particularly in the small bowel, is extremely striking.

The status of a patient with malignant obstruction of the large bowel is related to the length of time the obstruction has endured, the extent of the malignant disease, and the presence of concomitant constitutional disease. Among the fatal cases in this series 1 patient was in good condition, 11 were in fair condition, and 6 were in poor condition. Among the patients who survived, only 2 were in poor condition; 1 of these was the patient already mentioned, who sustained a perforation of the sigmoid which localized into a paracecal abscess.

#### DIAGNOSTIC CONSIDERATIONS

In the great majority of cases in this series the diagnosis was correct or obstruction of the large bowel due to malignancy was listed as an alternative diagnosis. Small bowel obstruction was the only diagnosis or an alternative diagnosis in 6 cases, volvulus in 4, acute appendicitis in 3, acute cholecystitis in 2, and diverticulitis and paralytic ileus in 1 case each.

An analysis of the cases incorrectly diagnosed as small bowel obstruction is instructive. In 2 cases the obstruction was due to carcinoma of the cecum. It is actually impossible to differentiate obstruction at the ileocecal junction due to this cause from any other type of low ileal obstruction by either clinical or roentgenologic methods, but the diagnostic error is important: Many surgeons would be tempted, in such cases, to use conservative measures, such as would be justified in simple obstructions of the small bowel. In 2 other cases diagnosed as small bowel obstruction the obstruction was due to carcinoma of the right colon, in which abdominal distention is often not as marked as in carcinoma of the left colon. In the fifth case there was marked distention of both

TABLE 1  
*Right-Sided Malignant Obstruction of the Large Bowel*

	Cecum		Hepatic flexure		Ascending Colon		Right transverse colon		Total Cases	Total Deaths
	Cases	Deaths	Cases	Deaths	Cases	Deaths	Cases	Deaths		
Cecostomy	..	..	1	..	..	..	..	..	1	..
Resection	2	2	1	..	..	..	1	..	4	2
Ileotransverse colostomy	2	1	2*	..	1**	..	1	..	6	1
Ileostomy	1	1	..	..	1	1	..	..	2	2
Conservative therapy	..	..	1	1	..	..	..	..	1	1
Total	5	4	5	1	2	1	2	..	14	6

\*One with ileostomy.

\*\*With decompression through appendiceal stump.

TABLE 2  
*Left-Sided Malignant Obstruction of the Large Bowel*

	Left transverse colon		Splenic flexure		Descending colon		Sigmoid		Recto-sigmoid		Total Cases	Total Deaths
	Cases	Deaths	Cases	Deaths	Cases	Deaths	Cases	Deaths	Cases	Deaths		
Cecostomy	1	..	5	2	2	..	12	3	3*	1	23	6
Resection	..	..	1	1	..	..	5	2	..	..	6	3
Ileotransverse colostomy	..	..	2	..	..	..	1	..	1	1	4	1
Devine colostomy	..	..	..	..	2	1	..	..	1	..	3	1
Sigmoidostomy	..	..	..	..	..	..	2	..	..	..	2	..
Drainage paracecal abscess	..	..	..	..	..	..	1	..	..	..	1	..
Conservative therapy	..	..	..	..	1	..	1	1	..	..	2	1
Total	1	..	8	3	5	1	22	6	5	2	41	12

\*One with Lahey colostomy.



large and small bowel, and on the surface there seemed no reason for the diagnosis of small bowel obstruction. In the sixth case, because of an old operative scar in the right lower quadrant, the surgeon assumed that he was dealing with small bowel obstruction due to adhesions in this region. No roentgenologic examination at all was made in the last case, nor was a barium enema done in any of the other cases, or indeed, in any case in which an incorrect diagnosis was made.

The frequency of apparent localization of the symptoms and signs in the right lower quadrant, which has already been commented upon, is the obvious explanation of the diagnosis of acute appendicitis in malignant obstruction of the large bowel. The phenomenon is most likely to occur when the obstruction is in the right side of the colon, though it can also occur when left-sided lesions are present. It is explained by the ready distensibility of the cecum and the fact that this part of the intestine is frequently in close proximity to the abdominal wall so that tenderness can readily be elicited.

A low-grade fever, leukocytosis, and an increase in the proportion of polymorphonuclear leukocytes, which all may be present in malignant obstruction of the large bowel, probably as the result of ulceration and infection of the intestinal wall proximal to the growth, are further reasons for a possible incorrect diagnosis of acute appendicitis. In this connection, the following case is of special interest:

A 32 year old woman had had recurrent attacks of pain in the right lower quadrant, nausea and vomiting for 6 months. A few days after the latest attack she was operated on through a right rectus incision, on a diagnosis of acute appendicitis, which was not verified by the surgeon at operation or by the pathologist. She returned to the hospital 2 weeks after her discharge, with the same symptoms as before operation and with marked abdominal distention in addition. A barium enema at this time permitted the diagnosis of obstruction due to carcinoma of the sigmoid colon, which was relieved by colostomy.

Carcinoma of the colon, it might be mentioned, introduces a reverse diagnostic problem in acute appendicitis. In Boyce's<sup>5</sup> material on acute appendicitis, collected over an almost 16-year period from Charity Hospital of Louisiana at New Orleans, 3 patients over 40 years of age died without operation from appendiceal peritonitis because a diagnosis of carcinoma of the colon had been made, while operation was delayed in 6 other cases, 1 of which ended fatally, because the patients were being prepared for surgery on the same mistaken diagnosis.

In some of the cases in which the right side of the colon was

resected for obstructing malignancy the pathologist reported the appendix to be acutely inflamed. Undoubtedly in such cases the pathologic changes are the result of back pressure from the cecum, which causes inflammatory changes in the wall of the appendix, just as in the wall of the cecum or the colon proximal to the obstructing growth.

The incorrect diagnoses in this series are significant from the standpoint of their responsibility for delay in surgical therapy. A patient with obstruction due to a paralytic ileus is not likely to be operated on at all. A patient with cholecystitis may or may not be operated on, while many surgeons make it a principle not to operate immediately if at all for presumed simple obstruction of the small bowel. A patient with a volvulus, however, and a patient with acute appendicitis is usually operated on without delay, and these particular errors, fortunately, were in the category of conditions which demand prompt operation.

Many cases in this series illustrate the need for continuing the study of a patient after one disease is diagnosed, to make certain that another does not exist. A 78 year old woman, for instance, who had been submitted to gastrectomy for carcinoma of the stomach 19 years before, had a series of acute gastrointestinal disturbances over a 4 month period which were diagnosed as due to cholelithiasis. Roentgenologic examination revealed numerous stones, and the dye test revealed a nonfunctioning gallbladder. Twenty-four hours after a particularly violent attack, associated with distention, a flat plate of the abdomen revealed intestinal obstruction by a growth in the sigmoid. Primary resection of a small annular carcinoma in this location was followed by complete recovery after, however, a very stormy convalescence.

The surgeon who encounters a patient with complete obstruction of the large bowel has no choice but to deal with the lesion as he finds it. Even in a paper of this sort, however, it seems important to comment on certain considerations not directly related to the therapeutic problem. One of these considerations concerns the well known fact that salvation in malignant disease in any location rests in the last analysis with the patient himself. Unless he seeks medical aid, medical aid cannot be given to him.

It is therefore as ironic as it is tragic that 8 patients in this series did seek medical aid, at intervals varying from 1 to 18 months before they entered the hospital, and received no aid at all. Three were told by the physicians whom they consulted to take purgatives. One was given medicine, the nature of which she did not know.

One was treated for 7 months for dysentery, which he might or might not have had also; the presence of *Shigella dysenteriae* or of *Endamoeba histolytica* in the stools does not rule out the presence of a concurrent neoplasm. One patient was told that he had a gastric ulcer, and the remaining patient was told that her abdominal symptoms were due to "trouble with her womb." The conclusion is inevitable that in none of these cases was the slightest attempt made to study the patients exhaustively and to arrive at an accurate diagnosis, though most of them presented the well known triad of altered bowel function, melena, and cramping abdominal pain of unexplained origin.

In this same connection it might be mentioned that 1 patient in the series had been operated on 18 months before for "a questionable lesion of the colon," though the surgical procedure had been limited to the release of adhesions. Two others had been submitted to appendectomy 15 months, and 2 weeks, respectively, before acute obstruction developed. Carcinoma of the colon was probably responsible for the symptoms in the first of these cases and positively responsible for them in the second. Still another patient had been operated on for acute obstruction 3 months before; cecostomy was performed for what was then diagnosed as a volvulus of the cecum. In each of these cases, too, it seems fair to assume that more exhaustive study before operation, or more adequate exploration when the abdomen was opened, might have resulted in earlier radical therapy and prevented the development of the later complication.

*Roentgenologic Diagnosis.*—Because of my personal convictions as to the value of the barium enema in cases of malignant occlusion—or indeed any occlusion—of the large bowel, I am impressed by the fact that in this series this method of examination was used before operation in only 15 or the 55 cases. It seems significant, as has already been indicated, that it was not employed in any incorrectly diagnosed case. Even if the diagnosis of colonic obstruction can be definitely made without the assistance of the roentgenogram, the enema is necessary for exact localization of the growth, so that the incision will be correctly placed in reference to it and that exploration at operation can be reduced to a minimum.

Certain precautions, of course, are necessary. The barium must be introduced very gently and slowly and under low pressure, and care must be taken that it is not forced past the site of obstruction, for two reasons. In the first place, the exertion of undue pressure can readily cause perforation of a friable, secondarily infected intestinal wall, infiltrated with malignancy, which lacks the distensible properties of the normal colon. In the second place, if barium

is forced past an incompletely obstructing growth, the possibility exists that the obstruction may be completed as the result of its presence. If barium remains in the right side of the colon for even a short period, the normal absorptive properties of the colon soon reduce it to an inspissated mass which can completely block the intestinal lumen. A case of this kind, which is not included in this series, recently came under my observation.

Useful as barium is in the diagnosis of obstruction of the large bowel when it is given in the form of an enema, it is extremely dangerous when it is given by mouth in any type of obstruction. The risk is so obvious that it needs no discussion. An incomplete obstruction may thus be converted into a complete one, the presence of the opaque medium in the bowel can greatly complicate the operation, and the risk of perforation is always present. In 1 case in this series, in which conservative treatment was used, the dual perforation of the bowel, in the transverse colon and the sigmoid, and the fatal fulminating generalized peritonitis can reasonably be attributed to the use of barium by mouth.

A flat plate of the abdomen was made in practically all cases in this series, with generally uniform findings, in the form of pronounced distention of the colon up to the site of the growth. Distention of the small bowel was present in a larger proportion of cases than the experience of Wangenstein<sup>4</sup> might indicate, though the exact number cannot be stated because in numerous instances the radiologists did not commit themselves as to the part of the intestine which presented this finding. Distention of the small intestine can be explained in several ways. When the ileocecal valve is incompetent, naturally the small bowel takes part in the proximal distention. Even when the valve is competent, it is logical to assume that pressure in the cecum will eventually reach such a point that the valve cannot open in response to ileal peristalsis and that obstruction of the small bowel, with subsequent distention, will eventually occur. Finally, when pronounced distention of the large bowel is present, plus extensive inflammatory changes in the wall of the colon, some degree of paralytic ileus is likely to occur in the small bowel. The chief importance of the presence of small bowel distention in association with large bowel obstruction is that the primary source of the occlusion may be overlooked and decompression by nonsurgical methods substituted for the surgical decompression which is essential for relief.

It should also be noted that carcinoma of the cecum with involvement of the ileocecal valve presents roentgenologic findings dis-

tinctly different from those observed in occlusion of the large bowel. There is no distention of the large bowel and the findings are typical of low small bowel obstruction.

Whether the plain film is taken with the patient in the upright position or supine is not a matter of great importance. The only additional information to be gained from the upright film is the presence of fluid levels, and that is of little practical importance.

#### THE FALLACY OF CONSERVATIVE THERAPY IN ACUTE MALIGNANT OBSTRUCTION OF THE LARGE BOWEL

The 3 cases in this series treated conservatively (Tables 1, 2) need no particular discussion. Two of them terminated fatally in the hospital. Necropsy examination in the first, a carcinoma of the sigmoid, revealed generalized peritonitis following perforation of the bowel at the hepatic flexure. In the second, a carcinoma at the hepatic flexure, the patient died suddenly after 15 days of hospitalization, with signs and symptoms suggestive of perforation of the cecum. The fact that the third patient was relieved of his obstruction must be written off as a fortunate outcome. The physician who elects to treat complete malignant obstruction of the large bowel by conservative measures is indulging in wishful thinking. As Pfeiffer and Martin<sup>6</sup> have put it, relief by this means may be hoped for but should not be expected.

Surgery was delayed in the hospital from 10 days to 34 days in 8 of the 37 patients who survived operation and was delayed from 2 to 14 days in 7 of the 15 patients who died after operation. The obstruction was relieved in the patients treated for 10 and for 34 days, respectively, but in each instance it recurred as soon as treatment was discontinued and surgery had to be resorted to. In at least 3 instances there seems little doubt that while an almost complete obstruction was being treated conservatively, the obstruction became complete. In another case the patient was being prepared for elective colectomy for carcinoma of the cecum by daily doses of castor oil. In the course of the preparation she developed signs and symptoms of acute obstruction, for which ileostomy was performed. Death occurred 48 hours later and necropsy revealed an obstructing carcinoma of the cecum which had perforated.

That intestinal intubation with a Miller-Abbott tube is of permanent, curative value in malignant obstruction (or any obstruction) of the large bowel is not now generally believed. It was practiced in 20 cases in this series, but the tube entered the small intestine in only 3 cases, 2 of which terminated fatally. Simple recollection of



the physiology of the colon will supply ample proof of the uselessness of this method so far as that portion of the bowel is concerned. When the ileocecal valve is competent, the colon is unable to empty its contents in the direction of the ileum, though the ileum continues to evacuate itself into the cecum, with rapid increase in the distention already present. The length of time necessary for the tube to traverse the distance from the stomach to the ileocecal junction is entirely too long to delay decompression of the large bowel. If, on the other hand, the tube can be passed with a reasonable degree of speed (which can be increased by the use of mercury in the balloon, as suggested by Harris<sup>7</sup>) it is definitely useful in deflating edematous, distended loops of small intestine and getting them out of the way, as well as in preventing further influx of the contents of the small intestine into the cecum. It usually has no other influence on the large bowel distention, however, and such relief as is secured may be highly misleading, by creating the impression that the patient is improving and by thus leading to further delay.

These remarks, of course, have nothing to do with the use of intubation after operation, which should be routine in all surgery of the large bowel. Simple duodenal suction is usually all that is necessary, and the Miller-Abbott tube need be employed only if small bowel distention is pronounced. One of the few criticisms which could be advanced against the postoperative treatment applied in this series was that in some cases the impression seems to have occurred that because the Miller-Abbott tube was not effective before operation, it would be of no value after operation.

There seems little need to present the case for decompression of the obstructed large bowel by surgical means (Tables 1, 2). It removes the immediate danger of impairment of the viability of the intestinal wall and of rupture of the growth as the result of increasing intraluminal pressure. It puts the bowel at rest, so that infection becomes quiescent and the number and virulence of bacteria within the lumen decrease. It permits healing of ulcers on the mucosal surface. It contributes to the reduction of edema of the wall, so that in some instances the patency of the lumen is restored and through and through irrigations are possible in preparation for radical surgery. It permits the prompt taking of food by mouth. It also permits the safe preparation of the patient for later surgical resection and, when that operation is performed, it controls colonic distention, so that tension on the suture line and impairment of the blood supply to the anastomosis are avoided. Very few surgeons would deny any of these claims. The question at issue is

almost never whether decompression should be done by surgical means, but rather what surgical means should be used.

#### SURGICAL PROCEDURES

*Resection.* Immediate resection was carried out 10 times, 5 times in obstruction of the sigmoid with 2 deaths, twice in obstruction of the cecum with 2 deaths, and once each in carcinoma of the hepatic and splenic flexures and of the right transverse colon; the patient with carcinoma of the splenic flexure also died. This is a prohibitive mortality, and it does not seem unduly harsh to say that the performance of this operation, in which the risk is very well known, reveals a fundamental misconception of the pathologic background of malignant obstruction of the large bowel, as well as of the therapeutic need of the patients affected with the disease. As already intimated, in this condition there are two problems to be dealt with. One, which is urgent and immediate, is the relief of the occlusion before the viability of the intestinal wall is irreversibly damaged by impairment of the circulation. The second problem, which is also urgent, but not immediately urgent, is the removal of the malignant tumor. Time can well be taken to save the patient from death in respect to the obstruction while preparing him for radical extirpation of the growth when he is no longer in jeopardy of his life.

When resection is done in the presence of obstruction, all the circumstances are against success. The condition of the patient is frequently very poor. The blood supply to the intestinal wall is likely to be impaired. The mucosa is ulcerated. Infection is present. The patient is dehydrated, starved and exhausted, and he may show impairment of the vascular system also.

That immediate resection is a temptation is freely admitted. At the present time, one-stage resections are actually safer than multiple stage operations, which need no longer be performed because of the magnitude of the procedure and for other reasons. But the safety of one-stage intestinal resection does not apply when the bowel is obstructed. It seems highly significant that the only patient in the group of fatal cases who presented a good risk when he was first seen lost that advantage when immediate resection was done. Two patients in the group of survivors who presented fair risks when they were first seen also lost that advantage when immediate resection was done, for the pathologist reported in each instance that the growth had been incompletely removed.

Three of the resections in this series were carried out by the same surgeon, and it seems unfortunate that the first of the 3 was

successful, for in each of the remaining cases the bowel was ruptured at operation and the patient died. The experience reminds one of Horsley's<sup>8</sup> remark that "There is such a thing as the operator being intoxicated with his own dexterity, which may on some occasions overbalance his best judgment of the procedure to be employed." Bunnell's<sup>9</sup> colloquialism, uttered almost 25 years ago, is still true, that in intestinal obstruction every manipulation is a shove nearer the grave. The fact that 5 of the 10 patients submitted to immediate resection survived the operation is no argument whatsoever in favor of the procedure.

It is known that resection was done in 22 of the 32 surviving patients in whom resection was not done at the first operation, with 21 immediate survivals. The only death was the result of atelectasis. The usual reason for failure to perform radical resection of the growth at a second operation was that the growth was inoperable or that metastases were present. Had resection been attempted in these cases at the first operation, it seems fair to say, on the basis of the 5 deaths in the 10 cases in which it was done, that a similarly prohibitive case fatality rate would probably have been achieved.

*Cecostomy.* Cecostomy was done in 24 cases in this series, with 6 fatalities; in 1 instance the operation followed a Lahey colostomy which did not function. That cecostomy is frequently a life-saving measure there is no doubt, and it has at least two other advantages, that it is perhaps the simplest of all decompression operations, and that it frequently closes spontaneously. But it has numerous disadvantages. Aseptic decompression is seldom possible with a cecostomy. Drainage of the bowel occurs directly onto the skin. The operation is difficult and dangerous to perform when the bowel wall is thin and distended. Exteriorization of an intact segment of the cecal wall is often impossible, and decompression is usually accomplished at the expense of some soiling. Decompression is likely to be less effective than when some type of colostomy is performed. Defunctionalization of the colon is not achieved by this type of operation. Infection of the wound is the rule, and wound dehiscence is not infrequent. Early ambulation is impractical for a patient with a cecostomy, whereas a patient with a colostomy can be promptly ambulatory. A secondary resection of the right colon is difficult because the bowel wall is plastered up against the peritoneal wall. A cecostomy which closes spontaneously eliminates the necessity for a second operation, but if spontaneous closure does not occur, surgical closure can be extremely difficult.

*Ileostomy.* In spite of these objections, if the malignant obstruction is on the right side, the choice lies among cecostomy with all

its disadvantages, ileostomy, and ileotransverse colostomy. The 2 cases in this series in which ileostomy was done both ended fatally, but both patients were almost moribund when they were first seen. In such cases, Rankin<sup>3</sup> suggested some 20 years ago, and as Wangenstein<sup>1</sup> also advocates, it is a feasible plan to open the terminal ileum and insert the catheter through the ileocecal valve into the cecum. Decompression by appendicostomy is a possible alternative.

*Ileotransverse Colostomy.* In right-sided obstruction, ileotransverse colostomy has the advantage of a primary anastomosis, so that there is no enterostomy to be dealt with at a subsequent operation. It is a safe and useful procedure in selected cases, in which the intestine proximal to the growth is not markedly distended, but it is more time-consuming than a simple enterostomy, which is a serious consideration in gravely ill patients, while if the ileocecal valve is competent, a closed loop still exists. Some type of decompression is necessary under these circumstances. In the 6 cases in which the operation was done in this series, an ileostomy was utilized in 1 case, while in another the surgeon performed appendectomy, decompressed the cecum via the appendiceal stump, and then closed the stump. Simple aspiration of the bowel is a simple, rapid procedure which frequently proves of value when technical difficulties are encountered in the manipulation of a greatly distended colon, but it was not used in any case in this series.

*Devine Colostomy.* Devine was the first to suggest the utilization of the right half of the transverse colon as the site of a temporary colostomy for lesions of the left half of the colon. It was done in 3 cases in this series. Defunctionalization is complete and satisfactory by this method, it is true, but the procedure is unduly complicated. In the single fatal case in this group it was directly responsible for the fatality. A white male, 31 years of age, in fair condition, was submitted to cecostomy for malignant obstruction of the cecum. Decompression was not entirely satisfactory, and 10 days after the first operation a second surgeon operated, with the idea of resecting the growth. Because of the inadequacy of the cecostomy in decompressing the colon, he performed a Devine colostomy. The application of the clamp on the distal loop immediately recreated a closed loop obstruction, and rupture of the bowel occurred 3 days later, with a promptly fatal outcome.

*Transverse Colostomy.* The opinion is increasing that simple loop colostomy of the transverse colon is the procedure of choice in carcinoma of the left colon, though it was performed in only 4 cases in this series. It has numerous advantages. The intestinal opening is considerably removed from incisions used for resection

of left-sided growths. The operation is readily performed, for the transverse colon is the most mobile portion of the intestine. If the operation is performed through a transverse incision, extrusion of the distended bowel is practically spontaneous, which it cannot be through a vertical incision, because of the twisting of the bowel on its axis. The use of a glass or plastic rod to support the bowel eliminates the necessity for suturing it to any of the layers of the abdominal wall, and thus avoids the infection which is almost inevitable when sutures are placed into the distended intestinal wall. The procedure is further simplified by the adoption of Wangenstein's<sup>1</sup> suggestion that during roentgenologic examination a small opaque object be placed over the umbilicus, for later identification of the transverse colon. Defunctionalization of the bowel is perhaps not as complete with a transverse colostomy as with the Devine operation, but it is entirely adequate. The proximity of the two openings may permit the passage of some fecal material from the proximal to the distal loop, but this is minimal if the bowel is completely sectioned. The patient with a transverse colostomy can consume his usual diet, and material accumulated in the descending colon can be easily evacuated. Surgical closure is necessary, but it is neither as hazardous nor as time-consuming as the closure of the partially exteriorized cecum. End-to-end closure can readily be performed, and the complications and difficulties of spur-formation and spur-crushing are avoided.

The good results of transverse colostomy are evident in such a report as Fallis',<sup>10</sup> which shows 62 such operations for acute obstruction of the left colon over a 10 year period, with only 2 deaths, 1 from embolism and the other from uremia.

#### OTHER THERAPEUTIC CONSIDERATIONS

*Anesthesia.* At both hospitals competent anesthetists were available in all cases, and in no instance did the anesthesia per se play any part in the fatal outcome. My personal preference, however, is for spinal analgesia in all cases in which abdominal distention is pronounced. The maximum of relaxation is obtained with it, and the excessive respiratory movements likely to be present during deep general anesthesia are not encountered. If the patient is unduly apprehensive, nitrous oxide or ethylene, or sodium pentothal, can be added. The frequency with which patients come to the operating table with gastric, duodenal or Miller-Abbott tubes in situ may complicate the use of general anesthesia, but it is perfectly feasible if spinal analgesia is contraindicated and if a competent anesthetist is available.



*Chemotherapy.* Chemotherapeutic and antibiotic agents were used in only 15 of the 55 cases in this series, the number including 5 of the 18 fatal cases. Whether a more liberal use of these new agents would have reduced the number of fatalities it is hard to say. The patient's equivocal status in many cases, the unwise surgical procedures adopted, and the long periods of temporizing measures introduced other factors which markedly influenced the outcome in many instances but which are difficult to reduce to tangible terms. Furthermore, the relatively large number of surgeons who handled this relatively small number of cases meant that technics of application and usage of chemotherapeutic and antibiotic agents differed greatly.

Some surgeons are perhaps too enthusiastic over the use of these new methods. In fact, one sometimes receives the impression that the agents are more important than the surgical measures employed. Some observers, notably Wangenstein,<sup>1</sup> who limits his use of these drugs to the implantation of a small amount of sulfathiazole about intestinal anastomoses, have achieved results without drugs quite as brilliant as the results obtained by those surgeons who use them liberally. My own feeling is that sound surgery is of preeminent importance, but that the adjunct use of penicillin in massive doses greatly improves the results in all large bowel lesions in which perforation has occurred or seems likely to occur. The method recently described by Crile<sup>11</sup> for appendiceal peritonitis—for all practical purposes appendiceal perforation and perforation of the large bowel are analogous—seems advisable. It consists of the use of 100,000 units of penicillin intramuscularly in procaine solution every 2 hours, or the use of the same amount by intravenous drip, over a 3 to 4 day period, or longer, followed by the use of 50,000 units every 2 hours, or of 100,000 units every 4 hours, for another 3 to 4 days.

*Suture Material.* The 4 instances of wound dehiscence in this series are perhaps the proportion to be expected in a series of cases of malignant obstruction due to carcinoma of the colon. No particular conclusions can be drawn as to why they occurred, because of the numerous varieties of suture material employed by the 25 physicians who handled the cases. The level of protein deficiencies in these patients was, of course, important.

My personal preference is for the use of fine cotton for the closure of all abdominal wounds, particularly in such cases as these. I also believe that the proportion of dehiscence can be reduced by the use of secondary wound closure in all cases in which there is spillage. Although the method was not used in any case in this

group, the literature indicates that Jones' suggestion that fine alloy steel wire be used in the form of buried figure-of-eight sutures is a valuable prophylaxis against wound separation in all varieties of conditions.

#### MORTALITY

Three previous series of cases of intestinal obstruction studied at the New Orleans Charity Hospital invite comparison with this series. In the first, reported by the late C. Jeff Miller<sup>12</sup> in 1929, there were 9 instances of malignant obstruction of the large bowel, with 7 deaths. In the second, reported by Moss<sup>13</sup> in 1934, there were 4 instances of this type of obstruction, with 2 deaths. In the third, reported by Boyce<sup>14</sup> in 1937, there were 11 such cases, with 9 deaths. The case fatality rates for these earlier series are worse than those for the series I have reported (32.7 per cent), but the latest series also bears out Rankin's<sup>3</sup> gloomy prophecy that even with the simplest possible surgery the case fatality rate for this type of obstruction will be at least 30 per cent, and that the rate will rise proportionately as more extensive surgery is done.

#### SUMMARY

Acute malignant obstruction of the large bowel puts the patient into double jeopardy, because a complication of the gravest import is superimposed upon a primary lesion that is in itself potentially lethal.

Malignant obstruction introduces such special considerations as the age of the patient, which is likely to be advanced; the less-than-good surgical risk which many patients present because of their underlying disease; and the necessity for a dual surgical procedure, the first concerned with the relief of the obstruction and the second with the radical extirpation of the lethal growth.

The physiologic considerations which prevail in small bowel obstruction are not present in large bowel obstruction, and for this reason immediate surgery, without delay for rehabilitation, is of chief importance.

A series of 55 cases of acute malignant obstruction, which occurred in 203 cases of carcinoma of the large bowel, is analyzed from several points of view, chiefly the diagnostic and the therapeutic.

The factors of mortality in these 55 cases, which resulted in 18 deaths (32.7 per cent), include (1) the age of some patients; (2) associated systemic disease in some cases; (3) the poor condition

of many patients; (4) the use of purgatives; (5) the use of barium by mouth; (6) delay in seeking medical aid; (7) the use of conservative treatment; (8) delay in surgical decompression, usually because of incorrect diagnoses or attempts at conservatism; (9) resection of the growth in the face of acute obstruction and other ill-chosen surgical procedures; (10) metastases.

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## ENDOMETRIOSIS

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**E**NDOMETRIOSIS occurs in the uterus, the tubes, the ovaries, the ovarian and uterine ligaments, the bladder, the peritoneal surfaces below the umbilicus, including the vesicovaginal and rectovaginal septa, the umbilicus, the inguinal regions, in laparotomy scars, and in distant locations. The term endometriosis was introduced by Sampson, who suggested that "misplaced endometrial or Mullerian tissue may be divided into 4, or possibly 5, groups, according to the manner in which this tissue reached its ectopic situation." These groups are:

1. Direct or Primary Endometriosis, a direct invasion of the myometrium by the mucosa lining the uterine cavity.
2. Peritoneal or Implantation Endometriosis, appearing first on the peritoneum with later invasion of underlying structures.
3. Transplantation Endometriosis, occurring in the scars of abdominal incisions after operation upon the pelvic organs.
4. Metastatic Endometriosis, which includes extraperitoneal lesions similar to those of metastasis from cancer.
5. Developmentally misplaced endometrial tissue.

Beginning with the paper of Rokitansky in 1860, dealing with adenomyomata of the uterus, a voluminous literature has accumulated, the masterly contributions of Cullen, beginning in 1896, and of Sampson, beginning in 1921, constituting epochs in the study of the subject. The various theories which have been advanced in explanation of the occurrence of endometrial-like tissue in locations other than the uterine cavity all have their adherents, with the result that the question of origin remains a controversial one.

Von Recklinghausen in 1896 was the first to advance a definite theory of origin of the glandular elements of adenomyomata, ascribing them to adult remains of the Wolffian system. He later advanced this theory to explain an adenomyoma in the distal end of the round ligament, arguing that since the ovarian gubernaculum has its origin at the lower pole of the kidney, and extends from the ovary as the utero-ovarian ligament, and from the uterus to the

groin as the round ligament, it might well carry portions of the Wolffian body into the inguinal canal. In one of our patients the only evidence of endometriosis was found in the right round ligament. At the age of 30 a fibromyomatous tumor of the uterus was removed, by transcervical section. At the time both ovaries appeared normal. Microscopic examination showed no pathology other than the tumor. Four years later, at the age of 34, a tender nodule situated at the external ring of the right inguinal canal was removed, and upon microscopic examination showed endometriosis of the round ligament. Four years later, at the age of 38, she again came under our care because of a tender mass in the right pelvis. At operation both ovaries showed cystic disease and were removed. To the naked eye neither cystic growth showed evidence of endometriosis, and microscopic examination failed to reveal implants in either. A solitary lesion of endometriosis could well be explained by displaced Wolffian or Mullerian tissue. At the time of Von Recklinghausen's contribution, this suggestion was also accepted as an explanation for the occurrence of adenomyomatous growths elsewhere in the pelvis, the uterus, the Fallopian tubes and rectovaginal septum. In 1896 Cullen first published his observations on uterine adenomyomata, attributing their origin to an invasion of the myometrium by uterine mucosa. His contributions have been accepted as proving the glandular inclusions of uterine adenomyomata to result from direct mucosal invasion from endometrial glands. He was unable to explain on this basis similar inclusions in distant organs, but was inclined to consider them due to displaced Mullerian rests. Previous to the publication of Cullen's work the presence of glandular tissue in uterine adenomyomata was rather widely thought to be due to inclusion of Mullerian rests, based on the fact that there is a close anatomic proximity of the anlage of the ovary and the Mullerian duct and that they are both derived from the celomic mesothelium and consequently that an interchange of cells from one anlage to the other might easily occur. The embryonal displacement of Mullerian tissue has been suggested by several authors as the origin of abberant endometrium in other locations without, however, explaining the mechanism of such distant displacements.

Following proven observations that under the influence of inflammation the endothelial cells of the peritoneum may be transformed into cylindrical or cuboidal cells came the serosal theory fortified by the further observation that the connective tissue surrounding such peritoneal inclusions can undergo hyperplasia and closely resemble the stroma of the uterine mucosa. This theory of heteropathy or metaplasia has also been held to apply to the germinal



epithelium of the ovary. Most of the German writers on the subject support it, attributing glandular inclusion formations to heteratopy of the celomic mesothelium, the peritoneum and germinal epithelium. Novak favors the theory of celomic origin of aberrant endometrium, believing that in adult life, probably under the influence of some unusual endocrine disturbance, the unused developmental potentialities of the peritoneum or germinal epithelium may be stimulated to the formation of endometrium or tubal epithelium. He considers this theory more logical than that of transtubal implantation because it offers at once an explanation for all types of endometriosis regardless of location.

In 1921 Sampson first published his implantation theory, according to which uterine or tubal epithelium may at times during menstruation escape through the Fallopian tube into the peritoneal cavity and, lodging on the ovary or adjacent pelvic structures, penetrate their surfaces and with continued growth give rise to the lesions which he has described under the general term, endometriosis. The lesions so formed react to menstruation and may develop into hematomata or chocolate cysts due to the retention of menstrual blood. Should such a cyst rupture under increasing tension, dissemination of its contents, including fragments of its endometrial lining, gives rise to fresh implantations. Sampson has demonstrated fragments of endometrium within the lumina of the lymph spaces and the venous sinuses of the uterine wall and believes they may give rise to typical uterine adenomyomata. He also suggests that endometriosis distantly located may be explained on such metastatic basis. Sampson's theory has met with wide acceptance in this country and England.

Novak has offered the following arguments against it: He has never seen regurgitation of menstrual blood through the Fallopian tubes in patients operated upon during the menstrual period. He argues that, should there be a retrograde transtubal menstruation, one would expect to find clinical evidence of peritoneal irritation such as occurs in ruptured ectopic pregnancy. Further, he states that in retrograde menstruation the endometrium would be forced to make its way against the physiologic travel in the tube and to overcome the obstruction offered by the tortuous course of the small intramural portion of the tube. And, finally, fragments of endometrium cast off during menstruation are composed of non-viable cells which do not have the power to grow after implantation.

Jacobsen and others have made successful autotransplantations of fresh endometrial tissue into the peritoneal cavities of rabbits and monkeys with resultant adenomata bearing a histologic resem-

blance to ectopic endometrial growths. Sampson and Jacobsen interpret these results as supporting the implantation theory. Novak and others contend that as the transplants consisted of fresh curettings and not of devitalized menstrual endometrium, the results offer no proof of Sampson's theory. The occurrence of endometrial-like tissue in lower abdominal scars following operations upon the uterus and tubes is explained by one school of thought on the assumption that bits of endometrial tissue have been transplanted in the abdominal wound, while another school favors the serosal theory.

From this brief review of the theories relating to the origin of ectopic endometrial tissue the difficulty of explaining all such lesions on any one hypothesis becomes apparent. The following case is thought worthy of report because of its direct bearing on the theory of implantation:

A 31 year old woman came under observation in November, 1939, with a discharging sinus in the left ischio-rectal region. She had been married for 6 years and in her history stated that she had not been pregnant. Periods until one year after marriage had been of irregular cycle and of 5 days' duration. Beginning one year after marriage prolongation of menstrual flow was noted, attaining in the last 2 years a duration of 5 to 18 days. Early in 1939 a hard, slightly sensitive swelling was noted in the left ischio-rectal fossa, which in May opened spontaneously, discharging a small quantity of thick, brownish fluid. At the subsequent menstrual periods approximately one half of the flow was discharged from the fistulous opening. During the intervals between the menstrual periods the discharge from the fistula was scant, not sufficient to require the wearing of a pad.

Physical examination showed a normal individual other than for the pelvic findings. The left ischio-rectal fossa showed a non-tender induration with an opening in the skin to the left of and slightly behind the anus: such of the lining as was visible was dark in color. Rectal palpation showed the induration to parallel the rectum and to extend into the pelvis. Vaginal examination showed the cervix normal in size and appearance and with the uterus to be fixed by an indurated, non-tender mass continuous with that in the ischio-rectal fossa.

At operation an elliptical incision included the fistulous opening with the anterior limb extending forward with the perineal margin. The tissue through which the fistula passed was hard, dense and brownish to black in color. When the dissection had proceeded to a point opposite the cervix a foreign body was encountered, which when extracted proved to be a section of catheter 4 inches in length. The remainder of the discolored tissue was removed as far as the fistulous opening in the uterus, which was located immediately above and to the left of the internal os. The opening in the uterus was denuded with a sharp curette and the wound packed with vaseline gauze. When confronted with the findings, the patient admitted that the catheter had been placed in the uterus 5 years before she came under our observation.

The wound was entirely healed at the end of 3 months and the menstrual function had resumed its premarital status.

Microscopic examination of the material removed at operation showed a small amount of fatty tissue, areas of inflammatory reaction in which there were lymphocytes, plasma cells, polys and endothelial cells containing blood pigment and a number of glandular structures similar to endometrial glands lined by single-layered columnar epithelium. Microscopic diagnosis: endometriosis; chronic and subacute inflammation; old hemorrhage.

In the light of the completed history it seems evident that the catheter remained in the uterine cavity for 4 years without inducing symptoms other than increased bleeding. Perforation of the uterine wall then occurred, with the catheter end projecting through the opening. Endometrial implantation followed, with eventual involvement of the entire fistulous tract from the uterus to the opening in the skin covering the ischio-rectal fossa.

Accurate diagnosis is essential to effective treatment. The interrelationship of diagnosis to treatment in the problem of endometriosis is of unusual importance to both patient and physician. The patient's age, the desire for and the possibility of pregnancy, and her sentiments towards the total loss of both ovaries, when interpreted in terms of the size and location of the lesion, offer a choice among the deferred treatment, conservative surgery, and either surgical or radiation castration. The young woman, who has been assured that no serious consequences will result from deferred operation, may, in the hope that the pelvic condition will subside or that she will become pregnant, prefer to suffer her mild discomfort rather than accept the 40 to 60 per cent risk of surgical castration. The young woman, in whom operation is unavoidable, either in the longing for a child, or the fear of premature menopause may earnestly desire conservative surgery with the associated risk of a second laparotomy. An older woman, who can anticipate an early menopause, may endure her disability with the expectation of its early termination. Upon the evaluation of such factors rests the policy of conservatism, morally and professionally so desirable.

No formula for the diagnosis of endometriosis exists. The symptoms produced vary so widely with the location, size, extent, and activity of the lesion that identification depends upon eliciting and properly interpreting the presenting complaints in their relationship to the menstrual cycle and the pelvic findings. As ovarian stimulation produces proliferation and engorgement of the ectopic endometrium, the classical patient suffers from pelvic pain during the days preceding menstruation. The pain fulminating with the flow and continuing throughout its duration is usually interpreted as dysmenorrhea. Pelvic comfort does not return for several days. This dysmenorrhea, once established, becomes more severe with each succeeding period. It is characteristic of this pelvic pain that heat, so soothing to most pelvic discomforts, by increasing engorge-

ment, aggravates its severity; and that antispasmodics are of but little benefit. If the pelvic mass is tender only during menstruation and if the tenderness elicited by bimanual examination is out of all proportion to the findings, the presence of endometriosis is to be disproved.

To this general picture may be added both menorrhagia and metrorrhagia by uterine adenomyosis, tenderness in the posterior fornix and dyspareunia by active lesions in the cul-de-sac, and both dyspareunia and dyschesia by involvement of the rectovaginal septum. If the bladder wall is invaded, frequency and dysuria result; if the intestinal wall, from slight digestive disturbances to obstruction. When extensive areas of the pelvis are involved, the massive, firm adhesions and the chronic inflammation may produce constant discomfort, there being a periodicity to the pain only should the lesions remain active. When pressure within a cyst becomes sufficient to suppress or destroy the endometrium, activity ceases and lesions of such size as to produce a bulging of the abdominal wall become asymptomatic. Endometrial ovarian cysts which have been previously silent may rupture, producing the signs and symptoms of acute peritonitis. Since the symptoms of endometriosis vary widely in their scope and individually are produced by many pelvic conditions, the classical case is rare. And so it is only the association of the individual complaints regulated by the menstrual flow which leads to a correct preoperative diagnosis.

In a series of 170 consecutive cases of endometriosis, the diagnosis being substantiated by microscopic study, the patients were fairly evenly distributed throughout the years of menstrual activity. It is to be observed that but one patient came to operation under the age of 20 and that the highest incidence was during the third decade.

Age Group	Number of Patients
15-20.....	1
20-25.....	11
25-30.....	30
30-35.....	47
35-40.....	46
40-45.....	15
45-49.....	19
50-55.....	1
Total.....	170

With 51 single women in the series, it is obvious that sterility is in some instances of no assistance to diagnosis. Of the 119 married

women 54, or 50 per cent, were childless, and of these 54 some 28 stated that they were unable to become pregnant. The 65 remaining married women possessed 155 children. While a secondary sterility undoubtedly existed in many cases, no particular effort had been made to establish the fact. Unless one is thinking in terms of endometriosis, the pertinent facts, such as the use of contraceptives, the desire for children, the separation of husband and wife, and the number of years elapsed since the last child, may be entirely overlooked.

Menstrual disturbances were uncommon. There were 24 instances of acquired dysmenorrhea, 9 of menorrhagia and 5 of metrorrhagia. The uterine bleeding was confined to the cases of uterine endometriosis, which produced a marked increase in the flow with either a low backache or mild pelvic discomfort.

Pain as a diagnostic aid was of but small assistance, being entirely absent in 59 cases. Generalized pelvic tenderness was present in 17, localized pelvic tenderness in 31, discomfort only during periods in 56, and sudden acute pain in 7.

In addition to those cases presenting complaints, there were 33 who were absolutely symptomless; 14 coming for physical examination and 19 because of an enlargement of the abdomen.

When in a series of 170 consecutive proven cases, the classical symptoms of acquired dysmenorrhea occurs but 24 times, of primary sterility but 28, and of characteristic pelvic pain in but 31, that no code for identification exists is clear. The difficulties already discussed are that the lesions, even when far advanced, may be entirely symptomless, that the suggestive complaints are but infrequently encountered, and that the symptomatology may at the time of operation not be one which could be interpreted as that of endometriosis. One additional barrier remains: in only 77 of the 170 cases did endometriosis occur alone. In 93 cases it was associated with other pelvic lesions, the presence of which rendered proper evaluation of the clinical problem more difficult:

Fibroids .....	51
Prolapse of uterus .....	7
Retroversion of uterus.....	21
Subinvolution .....	6
Chronic salpingitis .....	37
Sclerosis of tubes.....	16
Chronic oophoritis .....	11
Carcinoma of ovary.....	2
Dermoid of ovary.....	2



Benign ovarian cyst.....	9
Relaxation of perineum.....	5
Laceration and erosion of cervix.....	8

The incidence of fibroids and the presence of malignancy are worthy of note. The 53 cases in which diseased tubes were found at microscopic study constitute 31 per cent of the total patients and suggests one explanation for sterility. In studying the cases post-operatively it is impossible satisfactorily to establish the source of the symptoms. The endometriosis was limited to the pelvic organs, with a few implants in the serosa of the bladder, rectosigmoid, rectum, and intestines not listed below:

Both ovaries .....	91
One ovary; left 21, right 23.....	44
Uterus .....	15
Uterus and tubes.....	6
Ovaries and tubes.....	4
Ovaries, uterus and tubes.....	5
Ovaries and rectosigmoid.....	1
Ovaries, uterus and rectosigmoid.....	2
Vagina .....	1
Perirectal tissue .....	1

The affinity for the ovaries and the far advanced nature of the pelvic pathology accounts in part for the surgical castration essential to a complete cure in 66 per cent of the cases. The cases seen in the early stage of the disease numbered but 31. In 4 of these an opportunity presented itself to observe the patient from the beginning of her pelvic pain and tenderness until a mass developed. The lesions were palpable after 2, 5, 6 and 12 months. In 15 a small, tender, fixed mass was present in the vault associated with characteristic symptoms, and 12 were patients who had undergone conservative surgery. The second laparotomy was performed in from 1 to 14 years after the original procedure, the average interval being 5 years and 7 months. Unfortunately, of the 9 married women in this group of recurrences not one became pregnant.

#### OBSERVATIONS

1. The classical clinical entity of endometriosis is rarely encountered.
2. Endometriosis does produce the symptoms of any other pelvic lesion.
3. Endometriosis is found in association with every form of pelvic

pathology and, while innocuous alone, it may develop in company with carcinoma.

4. It shows a decided preference for the ovary; and in this series forced surgical castration in 66 per cent of the cases.
5. Meticulous care in eliciting symptoms, proper correlation of them with the menstrual flow, and accurate interpretation in terms of the pelvic findings are essential to diagnosis.
6. The incidence of preoperative diagnosis will rise slowly as the profession becomes more and more "endometriosis conscious."

## OSTEOMYELITIS TODAY

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**D**URING the past seven years advances made in chemotherapy and antibiotics have completely altered the complexion of a notoriously dismal disease.

In spite of complete agreement as to the value of the sulfonamides and penicillin, there remain great differences of opinion as to the indications for surgery in acute hematogenous osteomyelitis.

Two extremes of thought are represented. On the one hand there is a growing force of conservatives who advocate systemic treatment alone, unreservedly condemn surgical intervention, and recommend aspiration of abscesses rather than their incision for drainage.<sup>4</sup> Many avoid casts and splints.

On the other hand there are those who point out that early operative decompression of bone can today be carried out more safely than was ever possible before the advent of the sulfonamides. They quote figures indicating better functional results in operated than in non-operated cases.<sup>15</sup>

At this point one fact deserves special emphasis. Seldom are two cases of osteomyelitis exactly alike. It is a mistake to advocate one plan of treatment for all cases. Granted that good treatment requires a basic program founded on sound general principles. At the same time every case should be individualized from certain critical standpoints which occasionally indicate variations in the plan of treatment.

Now let's consider, in the light of present day medicine, those basic principles common to *all* cases of hematogenous osteomyelitis. Then, by studying the important variable factors and their relation to treatment, we can establish a rationale for individualization.

TABLE I

*Basic Principles*

1. Septicemia or Bacteriemia	Treat systematically first.
2. Infarction, as well as Infection	X-ray changes show too late.

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Read before the fifteenth annual Postgraduate Surgical Assembly of The South-eastern Surgical Congress, Louisville, Ky., March 10-12, 1947.

- |  |   |
|--|---|
| 3. Natural Barriers to Joint Invasion  | Cautious surgical approach.             |
| 4. Function requires Skeletal Rigidity | Preserve length and continuity of bone. |

TABLE II

*Influence of Penicillin on Basic Principles*

- |                               |                                     |
|-------------------------------|-------------------------------------|
| 1. Septicemia                 | Promptly cured in 95% plus cases.   |
| 2. Infection and Infarction   | Infection must be reached by drugs. |
| 3. Natural Barriers           | Uninfluenced.                       |
| 4. Function requires Rigidity | Uninfluenced.                       |

TABLE III

*Variables*

- |                         |   |
|-------------------------|---|
| 1. General Condition    | Surgery may have to wait.                           |
| 2. Stage when Diagnosed | Bone changes prevented only by early sterilization. |
| 3. Type of Organism     | Consider Staphylococcus Antitoxin.                  |
| 4. Bone Involved        | Flat bones have better prognosis.                   |

TABLE IV

*Influence of Penicillin on Variable Factors*

- |                         |                                    |
|-------------------------|------------------------------------|
| 1. General Condition    | Dramatically improved.             |
| 2. Stage when Diagnosed | Assumes tremendous importance now. |
| 3. Type of Organism     | Still of importance.               |
| 4. Bone involved        | Uninfluenced.                      |

Superficially it would appear that the whole problem of the treatment of hematogenous osteomyelitis had been solved by penicillin. Theoretically it is possible to reduce the incidence of chronic osteomyelitis of hematogenous origin by 95 per cent with penicillin. To accomplish this, however, the drug must be started before there has occurred any appreciable degree of bone infarction.

Usually, by the time the physician sees the patient and establishes his diagnosis, a bone abscess has already become established. Of course, one should start penicillin immediately, yet at this stage



Fig. 1. Case 1—treated early and adequately with penicillin. No gross infarction of bone nor periosteal stripping occurred. Minimal changes in the form of metaphyseal mottling persisted over one year.

the dosage must be directed not only at a septicemia, but with the intention of sterilizing even that area of bone which has been isolated from the blood stream by thrombosis. This implies a tissue concentration high enough to be effective through diffusion, since the drug cannot be distributed to the involved area directly by the circulation. The dosage required for this is tremendous—perhaps five times as much as that we have been accustomed to giving for ordinary infections.

Should we operate early? A conscientious answer is difficult. Before one can wisely decide as to the indication for surgical intervention, each of the previously mentioned facts and variables must



be considered in the light of its response to very large doses of penicillin.

There will be only a few cases in which surgery can help. When there is true mechanical (or hydrostatic) pressure from an abscess



Fig. 2. Case 2—seen too late for good result. Radiologist diagnosed septicemia from embolic type of abscesses on admission chest plate.

which is still under the periosteum, it needs mechanical relief. The classical type of adolescent osteomyelitis in the metaphysis of femur or tibia may build up rather high sub-periosteal tension, stripping the periosteum from one epiphyseal plate to the other before breaking through the tough enveloping membrane. A carefully done decompression early in this stage of the disease relieves pain and may prevent widespread bone necrosis. If a definite sub-periosteal abscess is encountered, the bone need not be disturbed. After evacuating the abscess, the periosteum is left open, but the skin may be closed primarily without a drain. Good judgment with individual consideration of many factors is required to pick the right time for

decompression. The decision is harder because of the dramatic improvement likely to result from penicillin administration alone. Operation, either before the periosteum has been elevated or after



Fig. 3. Case 2—widespread involvement of femur, with massive necrosis, sub-periosteal stripping, and impending pathologic fracture. X-ray changes follow actual infarction by several weeks.

it has ruptured spontaneously, will contribute nothing but a scar. If, in addition, the site of incision should allow contamination by secondary invaders, chronic infection with a penicillin-resistant flora may develop. This would be a tragic complication.

Regardless of whether simple conservative (i.e. medical treatment) or combined treatment has been used, the decision as to the need for external support must be based on x-ray changes. Although the x-ray is several weeks late in its representation of the viability of bone, it does reflect the stability at any given time. Adequate support by cast or splint is necessary when bone strength is threatened. Once sufficient involucrum has become established, function without impedimenta should be encouraged.

Treatment in the chronic stages has also changed as a result of modern antibacterial therapy. It is now possible to carry out safely

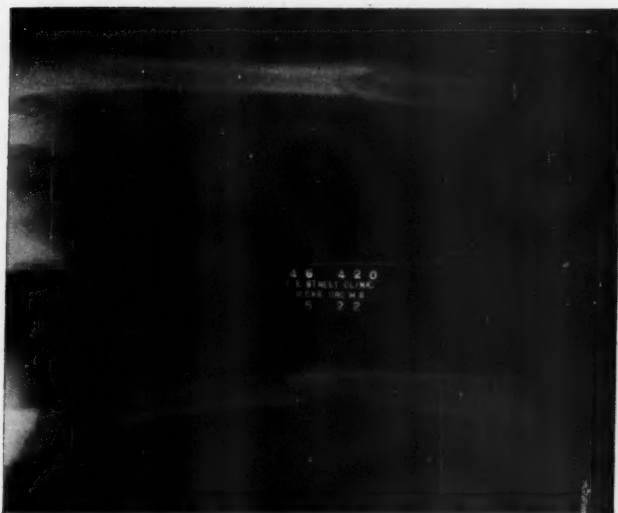


Fig. 4. Case 2—regenerating. Bone length and alignment have been preserved by cast, despite pathologic fracture.

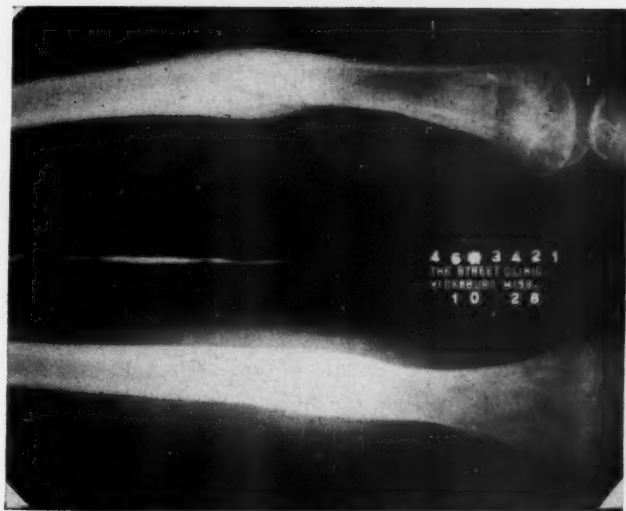


Fig. 5. Case 2—further regeneration, but with failure to absorb sequestrum. Sinus developed spontaneously after 8 months.

osteoplastic procedures such as radical saucerization and muscle flap obliteration of defects with relatively little danger. What is more, these extensive and previously hazardous procedures can be

followed by primary closure with complete healing in 60 to 80 per cent of cases. How permanent this apparent healing will be is still undetermined. Probably remissions of infection must still be ex-



Fig. 6. Case 3—long-standing, untreated low-grade infection. Massive sub-periosteal abscess found at operation. Sclerosis and overgrowth from prolonged elevation of the periosteum.

pected, and the old adage "once an osteo always an osteo" cannot yet be definitely said to have bowed to penicillin. Undoubtedly the availability of streptomycin will contribute another step forward in control of certain unusual infections.

X-rays of 4 cases currently under observation, may help to emphasize the foregoing statements.

#### CONCLUSIONS

1. The entire picture of hematogenous osteomyelitis has been greatly altered and brightened by the advent of powerful new antibiotics.

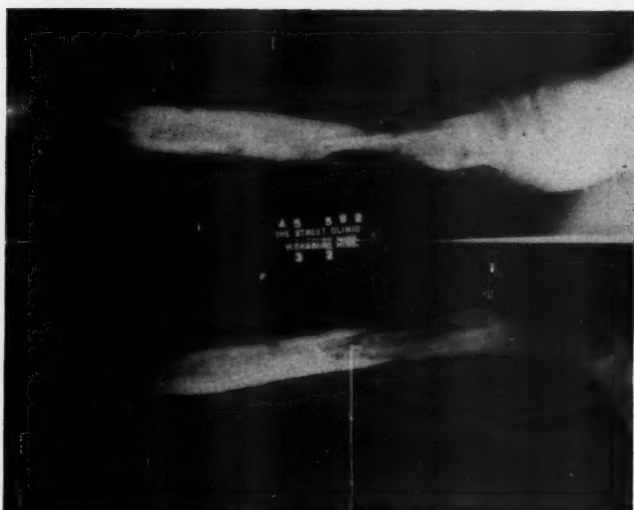


Fig. 7. Case 4—untreated. Massive sequestration, with periosteum stripped from one epiphysis to the other. Pathologic fracture and loss of alignment.

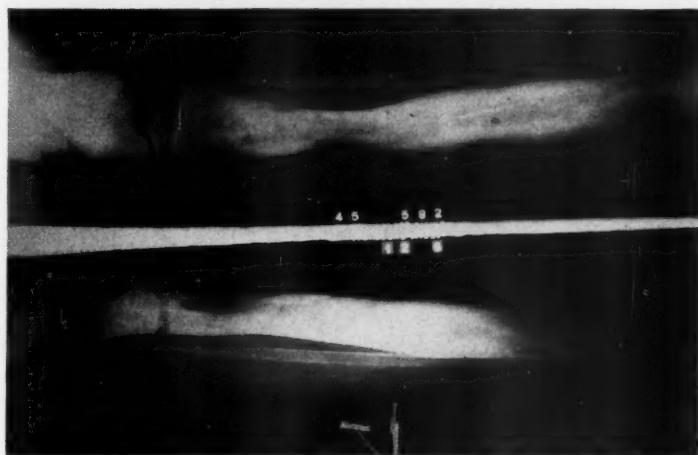


Fig. 8. Case 4—sufficient involucrum to permit osteoplasty.

2. Still there are many factors to consider in treating and prognosing a "bone infection." Comparison of individual cases is seldom fair.
3. Failure to start treatment early in the disease may result in per-



manent crippling due to irreversible bone changes which show on x-ray only after several weeks.

4. Penicillin is the best readily available agent today. It should be started promptly in massive doses (as much as 100,000 units every 3 hours) if one is suspicious of osteomyelitis. Smaller doses are ineffective when infarction of bone has occurred.

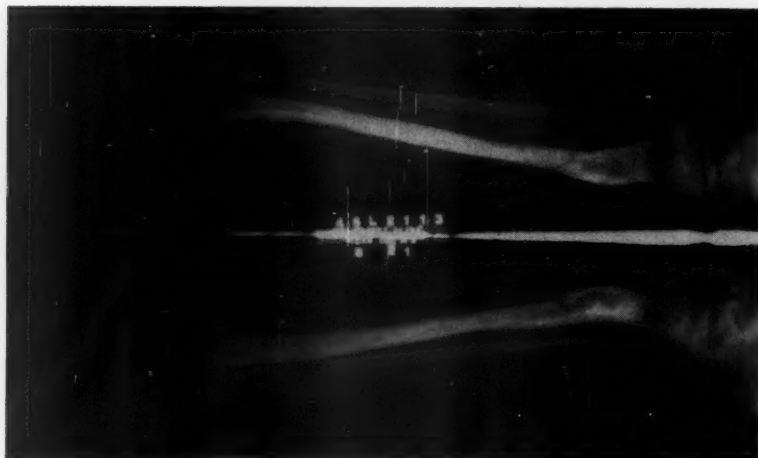


Fig. 9. Case 4—postoperative. Scars and sinuses in skin were excised and bone cleaned out and trimmed to permit primary closure. Safe osteotomy now possible to reestablish alignment.

5. The place for surgical decompression has become limited, but this operation will help prevent widespread bone necrosis when properly timed and carefully executed. If a sub-periosteal abscess develops, pressure should be relieved by surgical incision and evacuation. The periosteum is left open and the skin closed.
6. External support should be used only when necessary to prevent, or facilitate the healing of, a pathologic fracture.
7. Osteoplastic and reconstructive procedures can now be carried out for chronic osteomyelitis with less danger, and with better prospects for primary healing, than was possible before the advent of chemotherapy.

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## AMPUTATIONS ABOUT THE FOOT FOLLOWING TRAUMA

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I HESITATE to thrust upon a long suffering surgical audience a résumé of experiences in World War II. I am sure by this time that a great number of papers reflecting the experiences and lessons of military surgery are a welcomed deletion from medical programs. However, in certain phases of surgery, such as in the field of amputations, only an armed conflict with its inevitable high explosives, land mines and modern weapons of destruction can bring together the victims of certain surgical conditions in large enough numbers to be studied adequately so that definite conclusions can be drawn.

Early in World War II the Surgeon General of the United States Army set up in various parts of the country seven amputation centers where all patients with major amputations were hospitalized, whether definitive operation, preparation of the stump, fitting of the prosthesis, or training of the amputee was to be accomplished. It was my privilege during a period from Sept. 4, 1943, to Feb. 1, 1946, to have charge of one of these centers in which approximately 2,612 major amputees underwent treatment.

It is my purpose in this discussion to rationalize the surgical procedures utilized in amputations about the foot and ankle in the light of my own experience as well as of personal communications from other surgeons in charge of amputation centers. The standard surgical textbooks currently in use give descriptions and recommendations for stumps of Lisfranc, Chopart, Pirogoff and Ricard so that it is confusing for the surgeon to know what type of amputation is indicated in any particular case.

From a surgical point of view the foot is generally divided into two parts: the anterior foot, the portion distal to the tarsometatarsal articulation commonly known as Lisfranc's joint, and the posterior foot, that portion proximal to this articulation. Any amputation distal to the bases of the metatarsal bones in the anterior foot is satisfactory as the insertions of the leg muscles, the tibialis anticus, the tibialis posticus and the peroneals, are preserved and the balance of the foot is maintained. However, often this ampu-

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tation cannot be performed because it requires adequate plantar flaps for covering the bones of the tarsus and the average military casualties following land mine injuries have destruction of the soft parts of the sole so that amputation must be done at a higher level. The transmetatarsal amputation, however, can be satisfactorily fitted without special prosthesis. An ordinary full or three quarter shoe equipped with a metal shank extending throughout the sole and a sponge rubber insert to fill in the toe space left vacant by the loss of the phalanges and portions of the metatarsals serves satisfactorily. Patients maintaining motion at the ankle and mid-tarsal joints with a well balanced foot have a satisfactory gait and no deformity of the foot occurs.

Lisfranc first described his operation at the tarsometatarsal joint in 1815.<sup>1</sup> He used a long plantar flap and disarticulated through the metatarsal-tarsal articulation. The result itself is unsatisfactory because of the loss of insertion of the tibial and extensor muscles, and the unopposed action of the tendo Achilles invariably produces an equinus deformity. In addition, the loss of the peroneus longus leads to flattening of the internal arcade and the medial border of the foot pronates, touching the ground in walking.

The Chopart operation, first described by Lafiteau<sup>2</sup> in 1741, consists of a disarticulation at the astragaloscaphoid joint just behind the tuberosity of the scaphoid and externally at the calcaneocuboid joint. The stump end is covered with a long plantar flap. This leaves the os calcis with the astragalus superimposed anteriorly. The foot is weak anatomically for the anterior portion of it has been removed. The os calcis is soon drawn into extreme equinus by the unopposed pull of the Achilles tendon and the astragalus is then pulled forward between the tibia and the rotating calcaneus; weight-bearing is thus carried directly on the astragalar head and the tissues in this area frequently break down and ulcerate. In addition, the malalignment at the astragalotibial and the subastragalar joints caused by this displacement frequently results in painful traumatic arthritis. In my experience, it has been almost impossible to obtain a satisfactory prosthetic fit following a Chopart amputation. In order to attempt to prevent the development of equinus deformity it was necessary to use some type of rigid ankle mechanism with either side bars or shin piece extending on to the lower leg. The rigid ankle of the prosthetic device eliminates any advantage that might be gained by attempt to maintain the natural mechanism and, even though in a few instances a severe equinus deformity could be partially prevented, the gait is highly unsatisfactory. The same objections are applicable to amputations at the Lisfranc

level. Attempts were made in the past to remedy the defects which have been mentioned, particularly in the Chopart stump.

Ricard<sup>3</sup> described his operation in 1897. He removed the astragalus, rearticulating the os calcis in the tibiofibular mortise. This procedure conserved the mobility of the ankle, required a minimum plantar flap and tended to prevent equinus, because of functional lengthening of the Achilles tendon, but traumatic arthritis was prone to develop at the tibio calcaneal junction. Boyd<sup>4</sup> circumvented this latter objection by removing the astragalus and arthrodesing the calcaneotibial junction. This resulted in a fairly satisfactory stump which could bear weight without a prosthesis, but the stump end was too long to fit with a satisfactory prosthesis incorporating an ankle joint, so that no advantage from a prosthetic standpoint was gained.

The Pirogoff procedure,<sup>5</sup> first described in 1854 and widely practiced in central Europe, is an osteoplastic amputation with the posterior portion of the os calcis retaining the heel pad and turned forward to unite with the tibia and fibula after removal of the malleoli. With this technic it is difficult to obtain sound healing between the os calcis and the lower end of the tibia. Of 100 cases of the Pirogoff operation observed by Zur Verth<sup>6</sup> in Hamburg the results were good in 42 cases, mediocre in 45 cases and bad in 13 cases.

Orr<sup>7</sup> has expressed the opinion that "Practically the only argument in favor of the Chopart, Pirogoff and other amputations through the tarsal bones is that they produce an end-bearing stump, which enables the patient to walk without an artificial limb." It is generally considered by surgeons of experience that the objectionable features of these amputations far outweigh the beneficial features. It should be noted here that most of these procedures originated during the eighteenth and nineteenth centuries when it was extremely difficult for the average patient to obtain a prosthesis because of expense and because of the inability of a craftsman in that era to adapt the material available to him to a suitable appliance. The objections which were mentioned are substantiated by many men in the amputation prosthetic field. Thomas and Hadden<sup>8</sup> in their recent textbook on amputation prosthesis wrote, "The well-known classical amputations through the foot of Lisfranc, Chopart, and Pirogoff are still described and often recommended in many standard surgical texts but with the possible exception of the Lisfranc amputation through the tarsometatarsal joints these are undesirable from a prosthetic and functional viewpoint." In



countries where satisfactory prostheses are not readily available such operations may be useful. In this country, where the art of limb making is so highly developed and adequate prostheses are easily obtained, amputations at the higher level are to be preferred. Amputees as a rule expect a great deal more from the foot appliances than it is possible for any one maker to give them. Therefore, they are rarely satisfied with them. As a result some of the most prominent limb makers in this country, rather than have dissatisfied customers, refuse to make these foot appliances at all. The Surgeon General of the United States Army, advising amputation centers regarding Lisfranc's and Chopart's amputation, said that the former may be satisfactory if insertions to the anterior and lateral muscles are present; otherwise, amputations of this type are not considered satisfactory from the prosthetic standpoint and reamputation at the Syme's or mid-leg level is indicated.

Influenced by the reasonable desire of a number of patients to retain as much as possible of their partial foot amputation, in 8 cases I attempted to devise a simple technic of arthrodesing the subastragalar and ankle joints in partial foot amputation of the Chopart type which would eliminate the objectional equinus tendency and the development of traumatic arthritis, as well as allow satisfactory prosthetic fitting of this type of stump without reamputation. Vasconcelos<sup>9</sup> in 1937 described an operation in which the cartilage was removed from the tibio-astragalar and astragalocalcaneal articulations at the time of performance of the mid-tarsal disarticulation and thought this was probably an adequate solution of the problem of amputation of the posterior foot.

The technic we have devised consists of an anterior incision to expose the ankle joint and the lower five inches of the tibia. Cartilage is removed from the articular surface of the astragalus, tibia and fibula and a bone graft approximately 3 inches long is obtained from the anterior lower third of the tibia. Two three-eighth inch holes are drilled through the body of the astragalus and the posterior subastragalar joint. These two holes are connected by chiseling out the remaining bone and the graft is driven across the ankle and subastragalar joint, the upper end remaining in the lower end of the tibial bed where it is fixed with a stainless steel screw. It was found necessary to drill these holes for the placement of the graft in a posterolateral direction. In this manner approximately two thirds of the subastragalar joint is destroyed and we have had no difficulty in obtaining strong fusion of the subastragalar and ankle joints in any of the cases in which the procedure was performed. As soon as consolidation of these joints has taken place the patient can

walk very well with a walking plaster or modified boot but repeated attempts to construct a satisfactory prosthesis which is natural in appearance and not too cumbersome have been entirely unsuccessful. In any appliance we were able to devise, the only motion that could be incorporated in the prosthetic device was a toe break which would correspond to the normal metatarsophalangeal junction. The patients' gaits were not good and they were continually traumatizing the anterior portion of the distal end of the stump as they attempted to maintain a heel-to-toe gait in the normal manner. Subsequently, in 4 of these 8 cases reamputation was necessary; 3 of them at Syme's level were satisfactory and the other, at the patient's own request, was an ideal below-the-knee stump. I feel sure that the other 4 patients, all of whom returned to civilian life with the appliances provided, would have obtained a much more satisfactory result had a Syme's reamputation been performed. It required approximately twelve weeks to obtain fusion in the ankle and subastragalar joint, this time being entirely wasted in 50 per cent of the cases requiring reamputation. This experience completely condemns this procedure in our hands.

It is the opinion of the majority of chiefs of the amputation centers that the Syme's amputation offers the best solution to the problem of amputations of the foot proximal to the metatarsal base. This amputation was described over one hundred years ago<sup>10</sup> and probably has been the subject of more debate than any other major amputation. The Syme's amputation was employed rather extensively by British and Canadian surgeons during World War I. Many of the amputations performed by the Canadian medical officers have been followed for over twenty years; the operation is enthusiastically recommended by Harris<sup>11</sup> and Gallie,<sup>12</sup> who feel that it is the best amputation of the lower extremity, both from a functional and from a prosthetic viewpoint.

The indications, contraindications and technic of Syme's amputations have been most admirably presented by Alldredge and Thompson.<sup>13</sup> I will briefly review these principles, all of which have been pointed out by these authors. In the army amputation centers up until July, 1945, Holscher<sup>14</sup> found that over 200 Syme's amputations had been performed as a result of casualties of World War II. In only 2 instances did the patients require reamputation. One amputation in my own center was definitely contraindicated as the patient later was proved to have specific evidence of Buerger's disease; this was unquestionably an error in clinical judgment. The other reamputation was necessary because of inadequate skin flaps at the time of the original Syme's amputation and cannot be attrib-

uted directly to the method. We believe that Syme's amputation offers the best major amputation in the lower extremity because the longer stump gives better leverage and is capable of end-bearing without a prosthesis. Since the Syme prosthesis does not extend above the knee, the use of a thigh lacer or a pelvic belt is not necessary. It provides motion at the ankle joint in the prosthesis so that the patient has practically normal gait and he can engage in standing or walking occupations which require great endurance. Contrary to the view accepted by many limb fitters it was found in our own center that the fitting of a Syme prosthesis is simpler than fitting a below-the-knee stump and the prosthesis does not require as many adjustments. This is due to the fact that the Syme stump is fully end-bearing and the socket does not have to be fitted accurately to transmit the body weight to the skin of the leg as in the average below the knee prosthesis. Again, quoting Alldredge and Thompson,<sup>13</sup> "The Syme prosthesis is simpler to fit than any prosthesis which has yet been developed for the Chopart type of amputation." Patients who have had Syme's amputation have a better gait and far less pain and discomfort than those with poorly functioning short foot stumps. Syme's amputation is the only amputation recommended at the ankle joint, including the Pirogoff amputation. The cosmetic objection to the slightly bulbous ankle of the average Syme prosthesis might contraindicate this in a young woman but has not been a disadvantage in male patients.

Syme's amputation should not be performed in the presence of open wounds or sepsis and it usually must be done as a secondary procedure following an original open operation. It should not be performed upon diabetic patients or patients with peripheral vascular disease or loss of sensation following peripheral or central nerve injuries. It is imperative that there is sufficient plantar skin of good nerve supply beneath the heel to provide a weight bearing covering over the cut ends of the tibia and fibula. This requires at least 1.5 to 2 inches of skin distal to the point of the heel.

My personal experience with Syme's amputations is limited to 42 cases, performed either personally or under my direct supervision. The technic used in the majority of these cases has been that advocated by Gordon Dale,<sup>16</sup> surgeon at Christie Street Hospital. The incision begins at a fingerbreadth distal and anterior to the medial malleolus; the plantar incision crosses it at approximately 2 inches above the heel distally. The anterior linear incision crosses the dorsum of the foot at right angles to the plantar incision. After the skin has been incised, all tissues are divided from

the line of incision down to the bone. With the ankle joint opened anteriorly, the deltoid ligament and the calcaneofibular ligaments are divided and the talus is dislocated forward. Alldredge suggests the use of a bone hook inserted into the talus to assist in dislocating this bone. This is very useful. The os calcis is then resected subperiosteally with a sharp periosteal elevator or a gouge. The malleoli and the lower end of the tibia are then exposed subfascially and extraperiosteally by sharp dissection and cut across just above the articular surface of the tibia, care being taken to get the saw cut at right angles to the long axis of the patient's body. All tendons are pulled down and cut short and the plantar nerves are dissected out of the flap. Complete hemostasis is secured, the large vessels being tied before removal of the tourniquet. The edges of the skin flap are then approximated with interrupted nonabsorbable sutures, but the subcutaneous tissues are not sutured. A split piece of Dakin's tube is used as a drain in both angles of the wound, no attempt being made to excise the dog ears that result as the flap is approximated, since we feel that this would hazard the viability of the flap. The flap is maintained in this position by adhesive strips running mediolaterally and anteroposteriorly over the end of the stump and an Ace pressure dressing is applied and left on until sutures are removed at the end of 2 weeks. The drain is removed after 48 hours; after removal of the sutures a plaster cast is applied, followed by either a plaster walking boot or laced leather pylon. The patient walks with this device and the permanent prosthesis can be applied 8 to 12 weeks after amputation.

The subperiosteal resection of the calcaneus was preferred by us because we felt that for the operator who performs an occasional Syme's amputation there is probably less danger of injuring the blood supply of the flap by subperiosteal rather than extraperiosteal dissection of the calcaneus. The flap rapidly adheres to the tibial end and in from 7 to 10 days it is almost impossible to shift the flap. Thus, one of the chief difficulties associated with the after care of the Syme's amputation was eliminated. However, many of the operators in the army centers used extraperiosteal resection and their results are most satisfactory. Every one of these subperiosteal resections results in the formation of a calcified mass at the stump end because of the remaining periosteum but this has given us no difficulty so long as the edge of the periosteum is trimmed before final suture of the flap.

#### CONCLUSIONS

Wide experience based upon a large number of wartime casual-

ties has shown that any amputation distal to the base of the metatarsal bones in which proper indications for skin flaps has been met is a completely satisfactory amputation and should be performed at this level whenever possible. Any amputation proximal to this level or to the foot is unsatisfactory from a functional and prosthetic standpoint and Syme's amputation should be performed in these instances. In addition, we feel that the long perpetuated amputations through the mid-foot and hind foot, popular because of the retarded development and unavailability of prosthetic appliances, should be largely abandoned in our twentieth century surgery.

#### SUMMARY

1. The problem of partial foot amputations following traumatic injury and the time-honored surgical procedures used in these areas are discussed.

2. We have been unsuccessful in attempting to improve functionally and prosthetically the midtarsal amputation by arthrodesing the ankle and subastragalar joints.

3. The indications, advantages and results of the Syme's amputation as a substitute for partial foot amputation based on large wartime experience are discussed.

4. The technic of the Syme's amputation is described.

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## PRESSURES ON THE HEART

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I HAVE chosen this subject because it offers opportunity to clarify our ideas concerning diseases of the pericardium and other conditions that disturb the heart from the outside of the heart. My discussion is related to such familiar terms as cardiac tamponade, adhesive pericarditis, Pick's disease, pericardial effusions, hemopericardium, pneumopericardium, and so on. It has no relationship to such so-called diagnostic signs as Broadbent's sign, Friedreich's sign, Rotch's sign and Ewart's sign—all of which can be relegated to the past. We all know the internist has had his troubles in this field and while the x-ray has helped us greatly in diagnosis there is room for improvement. Our ideas of disturbed physiology are not always as clear as they should be and the same statement applies to treatment.

I can present some facts to you about these lesions that lie outside the heart and that disturb heart action. The proper place to begin is in the laboratory. Expose a dog's heart and determine in what ways you can disturb heart action. Then apply this information to human patients. If we follow this direct laboratory approach to the heart we can arrive at several conclusions. Heart action can be disturbed by (1) pressure, (2) angulation, (3) rotation. Additions to these may be made in the future. Traction in the long axis of the heart does not disturb heart action. I suspect we could disturb rhythm by outside conditions producing auricular tachycardia, auricular flutter, and ventricular extra systoles, but I have not investigated these possibilities and I do not believe anyone has done so.

I should like to discuss angulation and rotation first. I should like to discuss traction in relation to angulation and rotation. If you rotate a dog's heart, or if you angulate it out of its long axis, you will find that the heart rate increases, that arterial pressure falls and venous pressure rises. Marked tachycardia and even ventricular fibrillation may develop. If you pull the heart down towards the diaphragm little or nothing happens to pressures or rate. Even in long-term experiments the heart is not disturbed. We produced enough pull upon the heart to produce a traction aneurysm of the right ventricle without any obvious disturbance of cardiac function. Rotation and angulation are poorly tolerated. I have



demonstrated this by repeated experiments on dogs and I have observed similar responses during operation on the human heart.

What is the clinical application of these observations? There came into existence in the early part of this century the so-called Brauer operation of cardiolysis. This operation consisted in removing the bony precordium and replacing it by a soft yielding precordium so that when the heart pulled upon its harness of adhesions it pulled upon soft yielding structures rather than upon the unyielding ribs. This operation was confined to chest wall. Usually valvular disease complicated the picture. The hearts were large. The hypertrophy was supposed to be due to the pull upon adhesions. These ideas were never supported by experimental work. My judgment is that we proved them fallacious. Occasionally there was a good result obtained after the Brauer operation. Such results can be explained on the basis of rotation and angulation. The relaxation afforded by the operation reduced angulation and rotation, allowed the heart to go back into its normal position. There are instances of these dislocations seen following trauma to the chest, following inflammatory disease of the mediastinum, sometimes after pneumothorax in the treatment of pulmonary tuberculosis. The symptoms are tachycardia, attacks of syncope, sometimes made worse by certain positions of the chest. One patient brought on an attack by hyperextension of the chest, got relief by bending far forward. Correction of such malpositions can be done by direct operation on the heart with or without operation on the chest wall. Deformities of the chest wall more commonly produce pressure upon the heart.

We come now to pressure on the heart. This can be classified as acute and chronic, localized to one area of the heart or generalized over the entire heart. Let us first take up the physiology of pressure. We know that intrapericardial pressure normally is about —6 or —8 cm. of water. This is due to the elastic recoil of the lungs. If you increase the pressure in the pericardial cavity the venous structures are collapsed. Venous filling is retarded; venous pressure goes up. Venous pressure must stay above pressure on the heart. Otherwise the veins are collapsed and the heart does not fill. How much pressure can the heart stand? How high can venous pressure go? In the dog it is about 15 cm. of water; in the human it is somewhere between 20 and 30 cm. of water. What happens to the heart when you apply these pressures? The heart is compressed; it does not fill fully with blood. Diastole is incomplete. Systole is all right. The heart can empty itself but it cannot completely fill. Therefore, the heart is small. The compressed

heart is always small. It cannot dilate; it cannot hypertrophy. This point has been argued, but I think we must accept it. To this small quiet heart we add a falling arterial pressure and a rising venous pressure and we have a diagnostic triad for acute compression of the heart. This consists of a small quiet heart, a rising venous pressure and a falling arterial pressure. The term tamponade has been applied to this condition. I think acute pressure is a better term, because it tells what it is in two simple words.

Where do we see acute pressure clinically? If you are from the South you would say that you see it most commonly in stab wounds. The three best series of stab wounds came from Louisville, Atlanta and Richmond. It occurs in other conditions. Rupture of the root of the aorta produces it, as do also spontaneous and traumatic rupture of auricles and ventricles. These spontaneous and traumatic ruptures have never been operated upon. Not all such patients have died suddenly. Some have lived hours or days, giving ample opportunity to go ahead with operation. In the treatment of these conditions we have been too conservative. One patient, reported in the literature, had repeated hemorrhages and repeated admissions to a hospital, not unlike the repeated subarachnoid hemorrhages that occur in the brain and also the repeated hemorrhages that occur in aneurysm of the circle of Willis. This patient, who could have been cured by operation, died from spontaneous rupture of the right auricle. Other patients have died from rupture of ventricles following effort such as increasing intraabdominal pressure, sneezing and laughter. There are instances of rupture following cave-in accidents where legs and abdomen are engulfed in sand, earth, coal, etc. Intracardiac pressure is increased and rupture of the heart follows. Acute pressure is also seen in patients with purulent pericarditis. In these conditions the pus may collect rapidly in the pericardial cavity and produce pressure. The circulatory collapse that the patients show is due to pressure on the heart. The only thing added to the picture of pressure is that of sepsis. The cardiopericardial shadow may not be greatly enlarged. Pulsation is reduced. The heart is quiet. Treatment consists of aspiration of pus, introduction of 100,000 units of penicillin. This is repeated as necessary, and may cure the condition. If this treatment is not adequate open operation may be necessary.

Hemorrhage in the mediastinal cavity can produce pressure on the heart. Pneumothorax can also produce pressure on the heart.

We proceed now to chronic pressure on the heart. It takes a short time for acute pressure to change over to become chronic. It occurs in a period of one or more weeks. The changes that occur

in response to chronic pressure are several. The blood volume increases. This may go up to 30 to 35 per cent above normal and this increased blood volume helps to keep up venous pressure which in turn helps to fill the heart by overcoming the barrier of pressure on the heart. The heart is gradually enabled to withstand pressures that would stop the heart in the acute form. Pressure on the heart can go up to as high as 40 cm. of water in the chronic stage because the venous pressure can go up to higher levels. In the chronic form we have increased blood volume and higher pressures. What other changes take place? The heart undergoes atrophy of disuse; the entire organ gets smaller than normal. The muscle fibers get smaller than normal. For this reason complete cure does not follow immediately after the compression agent is removed by operation. The other changes that occur in chronic pressure result from venous stasis. The liver becomes enlarged and fluid filters out into the abdomen. It is an important point that the venous pressure must rise in 18 or 20 cm. of water before ascites forms. If a patient has ascites and a venous pressure below 18 or 20 cm. of water you can be certain that the patient does not have pressure on the heart. The essentials, then, in the diagnosis of chronic pressure on the heart are a small quiet heart, a venous pressure in the arm of 18 or 20 cm. of water, or higher, and ascites. The other secondary manifestations are cyanosis, distended veins, malnutrition, fatigue on exercise, narrow pulse pressure, paradoxical pulse, slurring and low voltage of the electrocardiogram. The diagnosis often can be made by inspection alone.

I should like to discuss another aspect of pressure on the heart and point out that the pressure may be generalized over both auricles and ventricles or it can be localized and confined to one part of the heart.

*Right sided compression:* I have had several patients with compression scars over the right auricle and ventricle. Under the fluroscope this part of the heart could be seen to be quiet, or without any pulsation. The operative approach was carried out to the right of the sternum.

*Compression of pulmonary artery:* One patient had a ring of calcium deposited around the pulmonary artery. This ring of calcium was unroofed and the artery became distended. The patient was cured.

*Strangulation of ventricles through opening in parietal pericardium:* This patient died without operation and the specimen was sent to me. This patient had received a severe contusive injury of

the chest. Later on he developed the signs of chronic compression of the heart. The reason for this was obvious when the specimen was examined. The parietal pericardium had an opening in it. Both ventricles entered this opening and with the heart beating the pericardium was pulled up on the heart so to speak and the heart got into greater and greater difficulty until finally it stopped beating. Cure could have been obtained by operation.

*Strangulation of both ventricles by encircling deposit of calcium:* This patient also died without operation and I saw the specimen. A deposit of calcium encircled the ventricles with the remainder of the heart free. It would have been entirely possible to cure this patient by operation.

*Basilar compression:* I have had a number of patients with compression of the pulmonary artery, aorta and auricles with the ventricles relatively free. These structures filled out with blood after the scar was removed and the patients were cured.

*Generalized compression scars:* This is a common form of compression. I have operated upon 57 patients for this lesion during the past 18 years. The compression scars were removed. The results in this series are as follows: Living and cured over period of 18 years, 39 or 68.4 per cent; improved 2, or 5.3 per cent. There were 10 postoperative deaths—5 from tuberculosis and 5 from other causes. Five patients died during the period of 18 years. There was only one operative death and this was due to ventricular fibrillation. At that time I did not know how to defibrillate the heart at the operating table. I think we could save this patient now.

*Compression from tumors:* One patient had a dermoid cyst adherent to the pulmonary artery and right auricle. This tumor mass was about as large as the heart. It was successfully removed and the patient is cured.

One patient had a tumor mass in the left ventricle lying between the descending and circumflex branches of the left coronary artery and covered by epicardium. The mass was the size of a tangerine. It had a calcified wall and the content of it was solidly packed debris of some kind without cellular morphology. This is the first case in which a tumor was successfully removed from the heart. The patient is living and without symptoms.

*Sarcoma of pericardium:* This is not such a rare condition. I have operated upon several patients and I have seen several others. I recommend operation consisting of removal of the left fifth cartilage, excision of a piece of parietal pericardium, and opening the

pleura so that the fluid drains into left chest, where it can be removed by aspiration, and then deep x-ray treatment.

*Compression by fluid:* This is a broad subject. Usually the pericardium dilates to hold the fluid. The clinical picture is that of compression. Treatment consists of aspiration. If you cannot aspirate fluid, operate and establish internal drainage into the left chest.

Finally, I should like to describe a new syndrome that, insofar as I know, has never been described. It is chronic compression due to fluid in the presence of a parietal pericardium that does not stretch. Two or three hundred c.c. of fluid can produce severe compression. You are led to believe the compression agent is scar rather than fluid. The treatment in these cases is removal of the parietal pericardium and establishment of internal drainage. Recently I obtained a cure by this procedure.

Another clinical syndrome is that in which the compression is not severe enough to produce ascites. This may be referred to as the preascitic stage of cardiac compression. These patients can be readily cured by operative treatment.

In conclusion I should like to say that we have advanced since the period of Broadbent, Friedreich, Rotch and Ewart. I should also like to say that progress in the future will depend upon the direct approach to the cardiovascular field and I look forward to the time when we will look not only on the outside of heart and blood vessels but on the inside of these structures as well.



## CARCINOMA OF THE BREAST: ITS TREATMENT AND PREVENTION

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**T**HE prevention of cancer of the breast, if ever possible, is more important than its treatment. Cancer of the breast is too important and too broad a subject to be presented in one paper. Consequently, as important and interesting as they are, no reference will be made to any of the other aspects than those of prevention and treatment—as all too frequently the latter has been relegated to one or two paragraphs in a more comprehensive presentation.

Thanks to the splendid educational program that has been and is being waged by the American Cancer Society, the average layman is today quite cancer-conscious: as a direct result we now see these cases in much earlier stages. But the best and surest way to “cure” any cancer is before it develops. Is there any way in which cancer can be “prevented”? No, no way by which it can certainly be prevented. But there are several conditions which predispose to the development of cancer. Among these, there are four on which I would like to focus your attention: position, lactation, stagnation, and mastitis.

First, the proper support of the breasts. As long as woman continued to live a quadripedal existence no artificial support for the breasts was needed, but when she assumed the upright position, the breasts sagged and, as a direct result, free and complete circulation in the upper half of the breast was inhibited. We believe that this is the explanation for the fact that pathologic lesions occur so much more frequently in that part of the breasts.

A good brassiere is perhaps one of the best preventives. To obtain a good one, however, is frequently a difficult problem. A perfect one should support the breast without constriction, and isn't too difficult to design, but for some reason is hard to find. Fortunately today, thanks to the influence of Mae West, a woman isn't ashamed of well-developed breasts and doesn't try to conceal them. The essential points of a good brassiere are that it be large enough to support without constricting, with cups to fit the breasts, and two straps on each side in front, which join to form one strap over each shoulder. The lateral of these two straps is the important one as it is the one which not only raises, but also pulls toward the mid-

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line, that portion of the breast most frequently involved by disease. The shoulder strap should be attached as near to the midline in the back as possible, to further this result, and should not contain any elastic. In theory, elasticity would allow movement and maintain support, but in practice elastic "gives" in a few days and the garment no longer fits. Elastic may be used in the lower portion, if desired, as this part doesn't affect the support of the breasts.

Secondly, the breasts should be used for their normal physiologic function, namely, lactation. They are attractive as secondary sex organs, but valuable as the best possible source of food for the baby. Both mother and baby will do better if the latter "nurses," but the percentage of babies who are breast-fed is alarmingly small. In a study of the babies born during the year 1944, in Rochester, Minn., 97.9 per cent of the mothers attempted to nurse their babies, but 35.1 per cent of these babies were weaned in less than one month, and 78.8 per cent nursed less than 6 months. It is at least encouraging to know that such a large percentage of mothers made an effort—but one wonders if they had been given the proper pre-natal diet and care of the nipple.

Unfortunately, many babies are weaned on advice of the pediatrician. He can more conveniently and accurately control the diet if the baby is on a formula only, and it is certainly much less confining for the mother, but the ultimate fate of each is thereby jeopardized. The pediatrician thus is unconsciously increasing the chances of carcinoma developing later. Both he and the obstetrician can do much good by insisting that there be more breast-fed babies.

Thirdly, stagnation. The late Dr. James Ewing said that if stagnation in the breast could be eradicated, cancer of that gland would largely disappear. If the breast is not carefully emptied after weaning the baby, or if milk, as it not infrequently is, continues to be secreted after weaning, or if the normal secretion which occurs after each ovulation stagnates, we find an irritating substance collected in the ducts and after years it may well prove to be carcinogenic.

Stagnation can be prevented or relieved by the intelligent use of a breast pump. We aid nature in caring for the skin by taking baths (cancer of the skin is most unusual in women who so carefully look after their skin). Toothbrushes are used regularly and assiduously (cancers rarely occur in the clean mouth). Laxatives are used when needed—so why shouldn't we aid nature in evacuating irritating material from the breast? Where anything is obtained from the nipple, I advise the nightly use of hot applications, followed by a

breast pump, until nothing is obtained for 7 consecutive nights, then a rest period of one month and then use of the breast pump until 7 more consecutive free nights have passed, and then a rest period of 2 months, and then the occasional use thereafter, and regular use when any discharge is obtained. Should the discharge ever become bloody and should the blood persist, more radical measures must be instituted. The discharge usually comes from an intracanalicular papilloma, but may be from an early cancer.

All three of the above are probably associated with, or contribute to, the formation of the fourth, namely, so called "chronic mastitis," an improper term, which usage has made correct, though it should better be called abnormal involution, or mastopathia. What name is applied to it matters little, but it remains one of the most aggravating conditions met with in the mammary glands. If not a pre-cancerous lesion, it provides a fertile ground in which cancers may develop. No one has ever proved at all conclusively that mastitides undergo malignant changes, but Dr. Ewing stressed the fact that he had never seen a cancer develop in normal breast tissue.

This condition constantly reminds the woman of her breasts and, being already cancer-conscious, she soon develops a phobia. About half of these patients may be relieved by the nightly use of moist heat, good supports (sometimes worn day and night), and the restricted use of the female sex hormone—10,000 units intramuscularly one week before the menses each month for 6 months.

Intractable or extensive cases should be dealt with radically, especially if the patient is over 35 years of age. In such an instance, a bilateral simple mastectomy is a conservative procedure and one which is good insurance. After recovering from the initial shock of losing part of her "appeal," such a patient is almost always most appreciative and grateful and carefree!

All these points may seem elementary, but, we feel, offer good insurance. If, however, a cancer does develop, the next best thing is to get it early.

The treatment of cancer of the breast is determined by many factors, namely:

1. Extent of the disease.
2. Nature of the tumor.
3. Age of the patient.
4. Physical condition of the patient.

There should be no standardized treatment to be applied to every case—it must be varied and individualized to fit the above factors. As a rule, however, the treatment should be radical, and should

utilize radiation and/or surgery. The ultimate outcome depends upon two factors, neither of which can be measured, namely, the malignancy of the tumor and the resistance of the patient to it.

The extent of the disease determines its operability. If one or more of the following are present the case should be considered as primarily inoperable:

- (a) distant metastases (in lymph nodes, lungs, liver, or bones)
- (b) secondary or daughter growths in the skin
- (c) fixation to the chest wall
- (d) fixed nodes in the axilla
- (e) swelling and edema of the arm.

By primary inoperability is meant that radical surgery should not be performed, except as a palliative measure. It is most important that the decision as to the operability of a lesion be determined before any radiation is given, and that this decision should not later be altered. Following radiation many patients, originally considered primarily inoperable, may improve to such an extent that later they appear to be operable. Grief is sure to follow if radical surgery is done on such patient.

The nature of the tumor is determined not only by its physical characteristics, but also by its rate of growth. A slow-growing one remains operable longer than a more rapidly growing one. If the tumor is more or less diffuse, and/or if it is extremely rapid-growing and/or if the overlying skin is red, warmer than the remaining skin, and edematous, it is probably a so-called inflammatory type carcinoma. Surgery should be avoided in such cases. These tumors are rapidly fatal, but the patient will live an average of 6 months longer if treated by radiation alone, and not by surgery combined with surgery.

The age of the patient should influence the degree of "radicalness"—the older the patient, the slower will be the progress of the tumor, and the less radical need be the surgery. No hard or fixed age limit can be set, but those patients over 65, or certainly over 70, will probably do just as well following a simple mastectomy, combined with pre- and postoperative radiation.

Closely associated with the consideration of age is that of physical condition—if it is not good enough to submit her to a radical mastectomy, we can do a palliative simple, with removal of the lower axillary nodes—a procedure I refer to as a "radical simple" or a "simple radical." It is not nearly so shocking to the patient and is much better tolerated.

If the case is a relatively early one, in a person less than 60 years

of age, and the tumor is not apparently the so-called "inflammatory type" carcinoma, and the general condition of the patient warrants a radical operation, we can use a "standard" treatment, which will be varied in other cases to suit the different conditions. I recommend a preoperative cycle of x-ray treatments, followed in from 10 to 21 days by a radical mastectomy, and a postoperative cycle, should the microscope findings indicate radiation effects, or that it is a radiation-sensitive tumor.

Radiation may be applied by x-rays or by interstitial radium. X-rays are much more generally used but there is great controversy as to whether or not they should be used preoperatively. The tendency today is *not* to use them, but I feel that they should be used. The objection to their use is that it delays surgical intervention for approximately 4 to 6 weeks. During this period, however, much is being accomplished. Cancer cells are killed, or at least attenuated, and the scar tissue resulting from the effects of radiation blocks the lymphatics, thus preventing or reducing the possible spread to other parts of the body. Strangely enough practically everyone advocates postoperative x-ray. If it is good postoperatively, I feel it is that much better preoperatively, and is the best insurance the patient can have.

In the early case under consideration, surgery should probably be radical, though I am about convinced that, instead of becoming more radical, our surgery will become less radical. As yet, I haven't the figures to substantiate this view, but I believe that our so-called 5-or-10-or-15 year "cures" exist in spite of our efforts, and not because of them. In other words, the result is governed by the extent of the disease, the nature of the neoplasm, and the "resistance" of the individual to it. I sometimes flatter myself in feeling that I have rendered the "sine qua non" until I recall some patient in whom only a palliative simple mastectomy was performed, but who is symptom-free after 15 years, and after seeing a goodly number of such cases, I began to wonder if we should be so radical in our surgery.

One must be radical, however, in the amount of skin removed. An early recurrence in the scar, or operative field, means one of two things, either (1) the incision did not go far enough around the tumor, or (2) the patient should not have been submitted to surgery. Three fingers' breadth from the tumor on all sides should be a minimum.

Few follow Mr. Geoffrey Keynes in his enthusiasm for interstitial radiation. The late Dr. Burton Lee did, and at one time felt it was the treatment of choice in early operable cases, but later relinquished the idea. In cases in which I used it preoperatively, I was

disappointed to find the effects of the radiation extended but a few millimeters from the gold tubes, and I no longer use it, except as a palliative measure.

Postoperatively, I advise one or more cycles of radiation according to the radiation-sensitivity of the tumor—and this is determined not merely by the pathologic report, but also by the response to preoperative radiation.

I feel that, in addition to the radiation to the field of operation and its regional lymphatics, in women in the premenopausal period, it is safer to give also a cycle of treatments over the ovaries. This not only "slows down" all breast tissue but prevents subsequent pregnancies, which I feel are hazardous. I have not done surgical castrations in young women, feeling that the desired results can be much more easily and safely obtained by radiation, though one must respect the opinion of so many good investigators who claim vaginal smears and aspiration biopsies of endometria, following a radiation-induced menopause, show signs of estrogenic activity.

I have not used, and therefore cannot speak with authority on, the use of the male sex hormone. Nor have I castrated a male patient with cancer of the breast as advocated by Adair, and can see no possible logic for such a procedure. If the former practice is good, the latter would appear to be contraindicated and, instead of destroying the testes, I would stimulate them to greater activity. Nor have I used stilbestrol in cases which show soft part metastases. If such is used, a hysterectomy must be performed so that menstrual bleeding will not be induced. If this is done, surgical castration can be carried out simultaneously. Those advocating this feel that stilbestrol should be used in large doses with soft part metastases and testosterone if the metastases are in bones.

If inoperable, attempts should be made to make the patient more comfortable. A simple mastectomy may eradicate a foul-smelling, sloughing mass. Palliation, however, is usually best obtained by radiation—x-ray and/or interstitial radium. Surprisingly enough, many of these apparently hopeless cases may do as well as or better than some originally considered as being "operable."

In each case, let the treatment be individualized to suit that particular patient; treat the patient and not the disease; in many cases it is obvious from the beginning that whatever is done will eventually be considered wrong: if too little is done, one may later wish he had been more radical; if there is an early recurrence, one wonders if that patient wouldn't have been more comfortable with a simple mastectomy or no surgery at all. If a patient has been palliated by

radiation, one may wish later that a surgical procedure had also been recommended. It is absolutely impossible to be right in all cases. Determine at the first visit what procedure will be instituted, which will be best for that particular patient, and don't use a routine one.



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## THE ROLE OF THE X-RAY IN THE DIAGNOSIS OF ACUTE APPENDICITIS

The differential diagnosis of acute abdominal surgical conditions has been reviewed many times, and it seems redundant to attempt to clarify our thinking concerning our preoperative examinations by still another communication. Our recent experiences, and those of preceding years, have convinced us that there still is much to be learned if we wish to save our patients from unnecessary surgical procedures. This applies particularly to the diagnosis of acute appendicitis. It seems absurd for an urologist to attempt to offer anything new in the diagnosis of a disease entity that is purely a general surgical problem; yet perhaps our experiences may be of some benefit to our surgical colleagues.

Let us, then, review some of the differential diagnoses that must be considered when a supposedly acute appendix is under consideration. All of these experiences have been personal and it was thought that some of our ideas might be helpful, as every surgeon from time to time has been amazed by the normalcy of an appendix that prior to the operation had been classified as "hot."

Twice we have seen a right-sided Richter's hernia mistaken for an acute appendix. Operation in both cases was a "must."

On one occasion, an acute vasitis was diagnosed as intestinal obstruction; again, a perfectly normal-looking appendix was removed

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in an emergency operation and, 48 hours later, an acute right epididymitis ensued. This was secondary to a gonococcal prostatitis and seminal vesiculitis. During the acute phase of the progress of the infection along the vas, it had produced all of the symptoms of a fulminating appendicitis—rigidity, pain, tenderness, fever, absence of peristaltic movement, even a moderate leukocytosis. Had the examining surgeon inquired in both cases, he would have ascertained the presence of the acute gonorrhea. In each case, to his postoperative inquiry, "Why didn't you tell me you had gonorrhea?" the patient replied, "You never asked me."

#### RULE NUMBER ONE: ALWAYS ASK QUESTIONS

Pathology in the urologic tract is frequently the source of symptoms which are interpreted as acute appendicitis. Many papers have been written in previous years concerning the differential diagnosis between intra- and extra-peritoneal lesions of the abdomen, and it shall not be the purpose of this communication to go into these problems in detail.

A movable kidney with a kinked ureter and an acute hydronephrosis on the right side has often been mistakenly diagnosed as acute appendicitis. In a recent review of our cases of ptosis with acute symptoms, 5 had already lost their appendices with this latter diagnosis. They may or may not have had the condition.

At a recent clinical-pathologic conference, we surveyed 6 cases of right ureteral calculi, all of whom had had an emergency appendectomy from 10 days to 6 weeks previous to their urologic studies. In every case, the operative attack on the appendix had been labeled preoperatively as "emergency" but when the patients were referred to the urologist for consultation, the plain x-ray plate, which is a preliminary to any complete urologic study, revealed the presence of the offending calculus. The complete urologic examination in each of these cases verified the presence of calculus in the right ureter, and a second operation was necessary.

The surgical approach to the ureter in all of these cases was much more than normally difficult because of the recent appendectomy. In fact, an extra-peritoneal approach to a calculus in the lower third of the ureter can be difficult enough as a primary procedure.

As a result of our discussions at this particular conference, one fact stood out above all others; namely, the length of time after admission to the hospital before the emergency appendectomy could be done. Not one single patient was operated upon under an hour

after admission. During the day, the delay was caused by lack of an immediately available operating room or kindred factors; at night, there was a delay while the anesthetist was summoned, the operating crew mobilized, and instruments sterilized. A white cell count and a microscopic examination of the urine is usually made while the patient is being prepared for laparotomy. Many other diagnostic aids are available in this hour before the operation, the most important of which, in our opinion, is a plain x-ray of the abdomen. This takes only a few moments. An opaque stone will show, as it did in all 6 of the cases under consideration. A more careful check might then be in order, and instead of an appendectomy the patient could be carefully examined urologically and the stone extracted either by cystoscopic methods (non-operative), or a fairly easy extra-peritoneal ureterotomy, whichever is indicated. In the event of a non-opaque stone being present, the error might not be preventable, and no one can find fault with the surgical philosophy that when in doubt it is better to remove a normal appendix than it is to temporize and have to deal with a ruptured appendix and peritonitis. In our experience, however, less than 10 per cent of all ureteral calculi are non-opaque. Certainly in all 6 of these cases the calculus was clearly visible on a plain film, and in each case two operations were done when one was indicated.

#### RULE NUMBER TWO: REMEMBER THE RIGHT URETER

##### *Conclusions:*

In all cases of so-called acute appendicitis, a plain x-ray of the abdomen should be made while the operating room and the patient are being prepared for an emergency appendectomy. It is our belief that a sufficient number of right ureteral calculi will be found to justify postponement of the emergency appendectomy to the betterment of the agreement of the preoperative and postoperative diagnoses of acute appendicitis.

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